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Evaluation

IN this, the last issue of *Flight* for the year 1949, there is included a comprehensive retrospect of the aeronautical activity which has taken place during the past twelve months: it makes an impressive picture. Now, on the threshold of the half-century, the British aviation industry—not only the aircraft and engine manufacturers, but the host of material and component concerns as well—is, generally speaking, in a very healthy state. Not that there is anything to be complacent about in its achievements to date—rather can they be said to be only what should rightfully have been expected; but, equally, there is little at which to cavil in any fair sense of dissatisfaction.

The whining dissident voices of the Jeremiahs have become all too familiar a feature of the post-war years—as if it were not bad enough in all conscience to have to contend with the stultifying effect of numberless restrictions, let alone be burdened with psychological sabotage within one's own fold. But, taken all in all, there is little cause for heartsearching: the Industry has done and is doing a corporate job of work of which all concerned can justifiably feel proud.

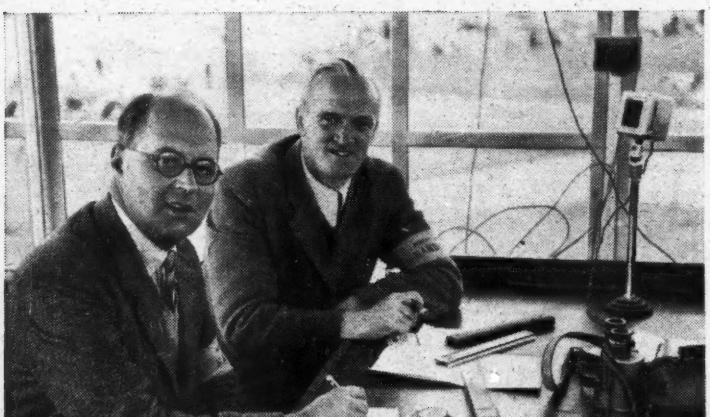
In some ways it is rather unfortunate that, of all industries, aviation is to-day perhaps the most dependent on Government support for continued health. So enormous have become the sums of money swallowed by the development costs of aircraft and engines that no individual company can reasonably afford to undertake the development of a prototype without financial assistance. The day of the Private Venture is gone—except, perhaps, in the instance of the more elementary types—and in its place the day of the Ministry Development Contract reigns supreme.

As such, it is no bad thing. In any case, it is a state of affairs that was undoubtedly inevitable, if only as a result of the technological advances made in all fields of aviation. The whole matter is aggravated by the comparatively small numbers of aircraft required for any given duty, for it is unlikely in the extreme that any manufacturer could be certain of a production order with a profit margin sufficiently large to cover the initial development costs. This does not apply, of course, to production in the frenetic forcing-house of war: but then everything is covered by contract anyway, and meeting the cost can be left until afterwards, as we now are being forced to realize.

There is no reason to believe that H.M. Treasury is inherently more parsimonious than that of any other country, although there is not much doubt that, with taxation approaching the upper limit of practicability (we say so with as much hope as conviction), and with the voracious demands made upon official funds by the multitude of "social advances" inaugurated since 1945, the amount which can be spared for the essential sustenance of aviation is little enough in all conscience.

By comparison with the financial resources enjoyed by our friends on the other side of the Atlantic, we are poorly off. Yet it has been demonstrated over and over again, and especially during the past decade, that aeronautical progress, and, indeed, scientific progress as a whole, is not even chiefly a matter of money, nor of man-power, in quantitative terms. In some ways it is reassuring to reflect that quality is still a paramount factor in many fields of endeavour, despite the lamentable cheapening of standards which has come about as a result of current doctrines of everything for everybody, deserving or undeserving.

If quality can be kept as a paramount criterion then there is hope for us in Great Britain, for just so long as we can maintain what should be our traditional standards of quality, then just so long can we afford to leave the matter of quantity to take care of itself. So far as the British aviation industry is concerned we have no cause for fear on that score: *Flight* believes this to be a truth which in 1950 is as certain to be emphasized as it was in the year past.



THE OLD FIRM

Air Race Handicappers Who Have Helped to Make History : The Story of Rowarth and Dancy

By B. J. HURREN

The firm in session : Fred Rowarth (right) and Wilfred Dancy, complete with paraphernalia, at the Folkestone races in 1946.
"Flight" photograph.

WHEN the mid-century year of 1950 opens, the aviation world will feel—apart from the results of a general election—not only the end of an era but the termination of one of the happiest of informal partnerships. As many readers will know, the Old Firm of Air Race Handicappers, Rowarth and Dancy, have had their innings and Dancy is returning to the pavilion.

It is an appropriate time, then, to turn back a few pages in aviation's story and record for our own amusement and the wonder of our grandchildren events and incidents which have, in the main, never before appeared in print.

Most of these incidents have been locked away in someone's memory: for although the popular fiction is that Rowarth and Dancy became so expert that nobody beat their handicapping, the facts are to the contrary. It might take long for the truth to emerge from a deep, deep well, but some of these incidents reveal that there is something in the proverb "Never judge a sausage by its skin".

It may seem incredible, yet it is certainly true, that more than 20 years after a certain race the result is not definitely known. The circumstances are that the "winner"—at least, he who flew first past the post—had performed with such success that R. and D. took him on one side and finally browbeat him into admitting he had oversize cylinders. For this he was disqualified, and the race awarded to he who came second past the post.

Now this race involved three laps round a course with observers at the turning points. Mr. "B," who came second, and was eventually awarded the first prize, had strong reason to believe that he had missed the first turning point on the first lap. So, thinking quickly with that agile brain that later elevated him to the foremost rank of British test pilots, *after* he had crossed the finishing line he flew on and passed over the first turning point. On the ground, the observers honestly checked in the aircraft as having flown correctly round the point: what they did not know was that this passage was after the race had ended. It was some 20 years later when the confession of truth was made to Rowarth.

It was in 1921 that Rowarth and Dancy began their career of handicapping. They rated as assistants to Mr. R. J. Goodman Crouch and Colonel Bristowe, who was known as "The Magneto King." These were the Air Ministry's "neutral nominees," from whom R. and D. took over in full charge in 1928. Since then, they have handicapped nearly every air race in Britain, including such star events as the 1934 race to Australia and the 1936 contest to South Africa.

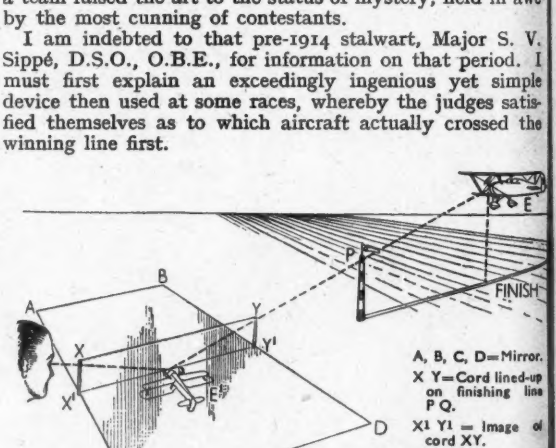
Their latest successes were at Elmdon, where, in the first series of National Air Races organized by the Royal Aero Club their handicapping produced excellent split-second finishes. At these races they had under instruction and guidance 12 nominees put forward by the Ministry of Supply, the Royal Aircraft Establishment, and the Air Registration Board, these rating as "neutral bodies." Whilst Dancy is retiring from handicapping, Rowarth is continuing until the end of the 1953 races to New Zealand.

Many of their successful coups of skill versus skulduggery have been forgotten, or dimmed by the best years that Hitler's paranoiacs wasted ; and only the clouds remember, in these days of Titans, that the minnows used to race at between 40 and 80 m.p.h.

Long before 1914, air racing was popular. Great crowds, often more than 20,000 strong, watched star meetings. The galaxy of silver trophies and fat cash prizes offered intrepid aviators during this close of the Edwardian era is astonishing, and those who wish to follow this halcyon period should study Major C. C. Turner's excellent book *The Old Flying Days*.

Alas! Diligent research has failed to track down any especially meritorious handicapper of that period and it was not until 20 years later that Rowarth and Dancy as a team raised the art to the status of mystery, held in awe by the most cunning of contestants.

I am indebted to that pre-1914 stalwart, Major S. V. Sippé, D.S.O., O.B.E., for information on that period. I must first explain an exceedingly ingenious yet simple device then used at some races, whereby the judges satisfied themselves as to which aircraft actually crossed the winning line first.



The ingenious timing device described below.

Reference to the diagram will show that the judge sat at a table directly opposite the finishing line—which might be a strip on the ground or two sighting posts. Before him was a table, on which, face up, was a plain mirror. Above this mirror, secured by two supports, was a piece of taut string, lined up exactly to the finishing line.

Now, the string was reflected in the mirror. Hence, the judge looking into the mirror saw in effect a prolongation of the finishing line. He could also see the image of aircraft crossing the finishing line, no matter at what height they might fly across in a close finish.

Incidentally, Major Sippé relates that this system was the origin of bomb sights—by careful pre-arrangement between pilot and observer, a close estimate of the trajectory of bombs was worked out.

A factor of no little importance is that in the early days every aircraft was known personally to the aviation world—a world on the threshold of discovery. Thus, for a handicapper, racing speeds were not so much a matter of aeronautical knowledge as the cumulative effect of bragging by the builders or pilots themselves. A rise from, say, 64 m.p.h. to 69 m.p.h. was something not to be kept secret.

Each aircraft was handicapped on its top speed. Hence, each pilot had a built-in bonus for good cornering and skilful navigation. Col. Lindsay Lloyd, who was clerk of the course to the Brooklands Automobile Racing Club, was an outstanding air racing handicapper.

Stripped for Action

Deadly rivals of those days were the Bristol Bullet and Sopwith Tabloid, between which there was little to choose. Hence, the pilots went to extreme measures to overcome their handicap, and an idea of the form can be gauged from the current slang: "So-and-so is flying without his collar stud."

The atmosphere of those early races can be captured in an anecdote about Ronnie Kemp. On the day before the first Circuit of Britain race in 1911 his machine failed to take off, because of insufficient lift. The ground crew worked all night to effect a makeshift extension to the wings. Sure enough, the next morning the aircraft managed to rise from the ground; but at a low altitude the improvised port-wing extension blew off, and the machine spun into the deck. That ended the question of the handicap of that aircraft.

The 1914-18 war ended the stick-and-string racing days, and the story moves to 1920, when the Royal Aero Club assumed control of handicap racing. To remove the handicappers from the suspicion of commercial interest, the Club asked the Air Ministry and Messrs. Ogilvy and Partners to nominate official handicappers. Captain Goodman Crouch and Colonel Bristowe were chosen, and moved into action for the Aerial Derby of 1920.

By 1922, Rowarth had become assistant to Goodman Crouch, and his first duty concerned the first of the King's Cup races. He tells me he vividly recalls borrowing brass screws from the longerons of an Avro Baby in order to make the magneto work and thus get S/L. "Barge" Payne airborne.

Croydon at this period became increasingly popular for air races. Here, the handicappers soon learned that they were sheep among the wolves. In one race, an Avro 504 arrived with streamlined wires and a large vertical windshield. The handicappers did their best, but the pilot won the first race at three-quarter throttle. Although his handicap was immediately adjusted, he won the second race—at full throttle . . . and again was penalized. But he also won the third race, for by this time he had entirely removed the vertical windshield . . .

Class Distinction

It was about this time that air racing was divided into major and junior races. In a "major," the aircraft had to be *exactly* as described on the entry form. In a "junior," alterations were permitted, but the handicap was adjusted accordingly. The reason for this latter action was largely convenience—the handicappers did not wish to discourage entrants to small meetings and therefore accepted the extra work of a junior class race. In a major race, there was not time to do this: Rowarth recalls one meeting where more than 50 out of 100 entries had to be altered to conform to the details on the entry form.

In 1925, 1926 and 1927, Dancy took over from Rowarth as assistant to Goodman Crouch. In these years air racing expanded vastly. The next year, 1928, both Crouch and Bristowe retired from handicapping, and Rowarth and Dancy took charge.

It soon became evident that the first-class professional test pilot was not at all necessarily a good racing pilot, and secondly that (as my old friend Tom Rose writes) "The real race was between handicappers and pilots before the 'off.'" Half the fun was to try and fox Rowarth and Dancy.

Consider the hazards in attempting this feat. In 1934, Capt. Norman Blackburn and Tommy Bancroft, having three years earlier won the King's Cup in a special Bluebird, decided to enter a standard version of this widely known type. With outward innocence and inward guile, they placed at the disposal of the scrutineers aircraft G-ACAH.

Unknown to Norman and Tommy, Rowarth spotted something odd from 70 yards distance, as he and Dancy were walking to the machine. "Don't say a word," said Rowarth in an aside, and, as outwardly innocent as the competitors, they came to inspect at close quarters.

Norman Blackburn writes of the incident: "The angle of the side-by-side windscreen had a marked effect on the speed . . . and we had flattened it from a standard 50 degrees to 30 degrees, feeling sure this would not be spotted.

"All went well: we were told to take the machine away. As Tom taxied off, I strolled nonchalantly away; not a stain on my character and conscience clear. But when I was about 20 yards away, Rowarth called out: 'Norman, you can put that windscreen back where you found it, and we'll have another look in an hour.'"

Another coup was brought off against a pilot who had ingeniously fitted a roller blind which, in flight, could be pulled out to deck-in a wide open cockpit. The Old Firm was not bamboozled: but the reaction of the pilot is to this day not known to them, for they adroitly removed the blind without telling him they had done so.

Western Approach

Then there was the colourful character from the West who casually twiddled a Colt round his index finger as Rowarth and Dancy were questioning him on the wing area of his Lambert Monocoupe.

The Prince of Wales (who was attending the meeting) drew near, and Westerner importuned him: "Say, will you write your name on my wing?"

"I can't do that," replied the Prince amiably, "I'd have to do it for everbody."

"O.K. Well, will you spit on it please?"

One surprising thing is that until the National Air Races this year so well-known an aviator as Jim Mollison had never been in a handicap race. And that raises another memory, which might well tax Rowarth to the hilt.

Announcements about the 1953 New Zealand race recall the Australia race of nearly 20 years before. In that long-ago event, one entry was a Fairey III F piloted by "Missionary" Davies of the R.A.F. (at one time, I believe, a General in some South American army) and navigated by Lt.-Cdr. "Burglar" Hill, R.N. I forget what the handicap was, but the first alighting on the race was made at Cyprus, where a wheel was damaged.

All question of getting III F spares to Cyprus in time was "out," and philosophically this happy team continued their race to Australia. Days passed into weeks, and weeks into months, as the faithful III F continued across the world, stage by stage. My memory has it that they eventually got to Melbourne after a flight of more than eleven months.

I cannot feel that an air race without these two competitors would be really satisfactory, especially as I last heard of the Missionary in New Zealand. But I would like to know exactly what handicap Rowarth proposes for them if they should enter for the 1953 event.

Tailpiece by Flight's *Art Editor: "Now they will NEVER be able to produce the line-abreast finish which they have been promising me for the past 21 years."*

HERE and THERE

Faster Ouragan

IT is reported that the second prototype of the French Marcel Dassault M.D. 450 Ouragan, Nene-powered jet fighter, is due to fly shortly, and that its maximum speed will be 650 m.p.h. The original Ouragan, which has been flying since February, is undergoing tests at Bretigny, where performance figures recorded include a top speed of 590 m.p.h. and initial rate of climb of 8,460 ft/min. The expected increase in speed of the second machine is possibly due to the use of thinner-section wings with 30 deg of sweep-back.

Teutonic Temerity

WALTER Galonska is the first German known to have built an aircraft since the war. He was charged on December 20th before a U.S. High Commission court in Frankfurt with having built a helicopter in a garage.

Galonska is said to have ideas for an engine which would enable any aircraft to reach 45,000 ft. He is also reported to have flown his helicopter inside the garage which, it is stated, has a high roof.

Rocket Realism

DESPITE the suggestion made in a national newspaper on December 22nd that the R.A.F. may use rocket-propelled fighters within the next two years, there is little likelihood that Service aircraft propelled solely by rocket units will reach squadron service by 1953. The use of rocket assistance for emergency climb and combat duty is, however, another matter altogether, and such power installations for British fighters may reasonably be expected to emerge during the next two years.

ON SHOW: At its first public demonstration (at Villacoublay) the S.O. 1110 Ariel was seen with a re-fashioned tail using twin vertical surfaces. The rotor is driven by tip jets supplied with air from a turbo-blower on the Mathis 220 h.p. engine.

Speed in Production

"A BRITISH light aircraft fitted with floats may be used to rescue 11 scientists and technicians marooned in the Antarctic . . . It will be created and sent to the Antarctic next month."
—From an Indian journal.

1950 King's Cup

IT is announced that the King's Cup Race has been allocated to the Wolverhampton Aero Cub, and that it will be held at Wolverhampton Airport on June 17th next year. The race will consist of three laps, totalling 100km., of a course from Wolverhampton to Abbots Bromley (Staffs), Meir (Staffs), and Newport (Salop).

Whereas the 1949 National Air Races were grouped in a three-day August Bank Holiday meeting, the success of which was disappointing, the decision has been taken that, for 1950, a "spread-over" programme will be tried, whereby individual races can be allocated, on request, to flying clubs for inclusion in a week-end meeting.

Lord Tedder for B.B.C.

WITH effect from January 1st—the day on which he voluntarily relinquishes the post of Chief of the Air Staff—Marshal of the R.A.F. Lord Tedder, begins a two-year appointment as a Governor of the B.B.C. One of the retiring Governors is Air Marshal Sir Richard Peck. Lord Tedder's successor as C.A.S. is Air Chief Marshal Sir John Slessor, Commandant of the Imperial Defence College.

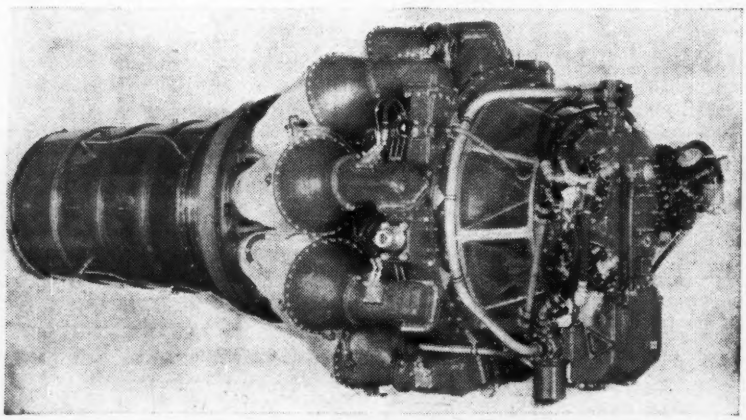
Afterthought

ONE of the most outstanding—and certainly the fastest—of events in the 1949 U.S. National Air Races, held at Cleveland last September, was the jet division of the Thompson Trophy Race, for which four North American F-86A Sabres were entered. Capt. Cunningham, U.S.A.F., the winning pilot, was officially credited with having flown one of the ten 15-mile laps at 635.444 m.p.h.

It is now reported from America that this speed—exceptional in itself—was calculated on the basis that 15 miles were flown on the fastest lap, and that, in fact, the distance covered was 18 miles. On this basis, the speed of Capt. Cunningham's Sabre would have worked out at some 760 m.p.h.—the equivalent Mach Number being approximately 1.

French Demonstration

TWO French pilots, Marcel Doree and Fred Nichole, sailed for America recently in the *Ile de France* with the prototype Fouga Cyclone jet-powered "glider." They are to demonstrate this unique light aircraft at Miami, Florida, on January 13th-15th, and then begin a three-month sales tour of the U.S.A., sponsored, it is reported, by the French Air Ministry. The Cyclone, which is powered by a 200-lb thrust



TURBO-WASP: The Rolls-Royce Nene built in the U.S.A. by Pratt and Whitney is designated JT-6B Turbo-Wasp. Changes have been made to the accessories casing to meet U.S. Navy needs, and materials, parts and accessories from U.S. sources have been incorporated.

HERE AND THERE . . .

Turbomeca light turbojet, is stated to have a maximum speed of 188 m.p.h. and ceiling of 30,000ft.

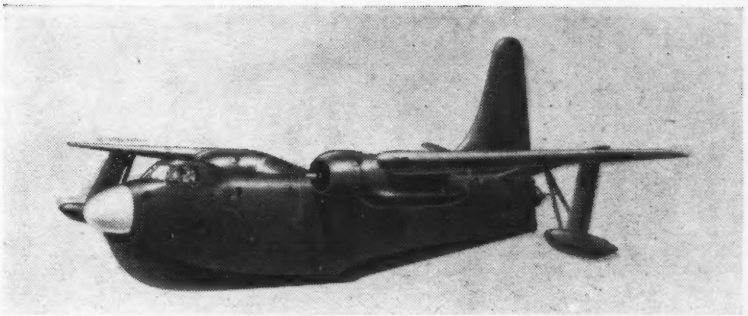
Coal Chutes

PIT parachutes for miners' cages have now been installed in a number of Soviet collieries, and, it is reported, will soon be part of the equipment of all Russian coalfields. During testing of the prototype parachute, a cage cable was cut 68 times while the cage was descending at varying speeds and loads. The parachute effectively retarded its fall on each occasion, and "experimental animals" inside the cage remained unharmed.

New U.S. Flying Boat

DESIGNED to succeed the U.S. Navy's Martin PBM Mariners used for patrol and cargo work, the new P5M-1 flying boat is the subject of an initial production order placed by the Navy with the Glenn L. Martin Company. As yet unnamed, the P5M-1 is the first post-war American twin-engine military flying boat to be developed.

As shown by the accompanying illustration, the new design bears some resemblance to the Mariner, with two engines mounted on the high gull-wing. The Wright R-3350 power units, however, will be rated at 2,700 h.p., instead of the 2,100-h.p. Pratt and Whitney radials of the Mariner. Other new features of the P5M-1 include the installation of a radar scanner in the bow, use of a single-step hull configuration and the single fin and rudder.



NAVAL TYPE : An artist's impression of the new Martin P5M-1 patrol flying boat referred to on this page. Interesting features shown are the single-step hull, with bow radar scanner and a large-calibre gun in the stern turret. Racks for bombs or depth-charges are apparently contained in the nacelles of the Wright 3350 engines.

NEWS IN BRIEF

MR. JOHN JAY IDE is back in Paris as the European representative of the National Advisory Committee for Aeronautics. He is well known in England and continues to make frequent visits to this country.

* * *

As trustees for the Queen's Cup, competed for annually under the organization of the Northern Heights Model Flying Club, the following have been appointed: Dr. A. P. Thurston, Sir Frank Spencer Spriggs, F/L. P. G. Lucas, and G/C. the Rev. George Hyslop; Mr. J. W. Morrell is hon. auditor, and W/C. C. M. N. Green hon. solicitor.

A new enterprise by Mr. C. G. Vokes, of filter fame, is the formation of a company to manufacture artificial limbs for the disabled.

* * *

W/C. R. H. Stocken, of Airco, Ltd., Eagle House, 109, Jermyn Street, London, S.W.1, has London-office representation facilities for Continental and other firms.

* * *

Mr. Everett B. Schaeffer, B.Sc., Mech. Eng., M.S., has been appointed chief technical engineer to Canadair, Ltd., while Mr. William B. O'Neal, B.A., B.Sc., Mech. Eng., joins as chief of design sections; Mr. Schaeffer comes from Boeing (at one time he was consultant to Cunliffe-Owen Aircraft in England) and Mr. O'Neal from Glenn Martin.

* * *

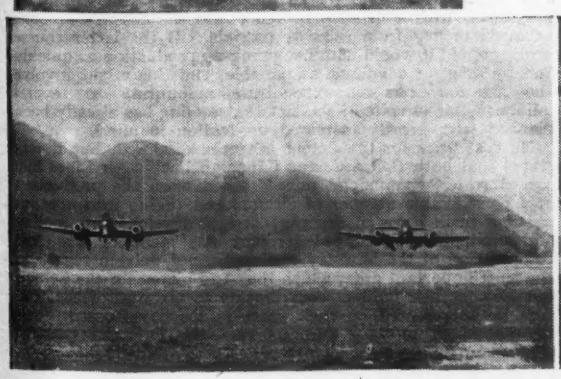
Mr. E. J. Nicholl.

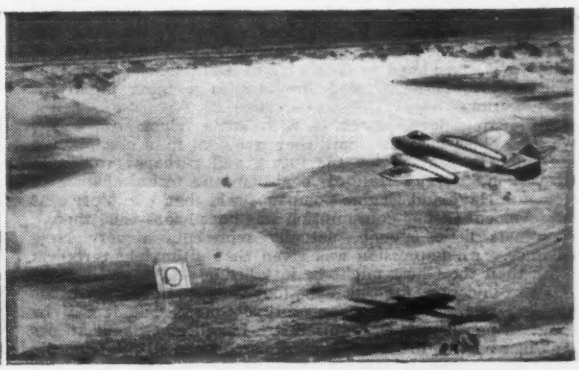
Mr. E. J. Nicholl, chief designer to Dowty Equipment, Ltd., has been appointed to the board of that company. With previous experience on the design staffs of both Percival Aircraft and Handley Page, Mr. Nicholl joined Dowty's in 1935 and was appointed chief designer in 1941.

* * *

His friends in the Service and the aviation industry will be glad to hear that A. Cdre. F. Kirk, now a director of the Fairey Clyde Aviation Company of Sydney, Australia, has completely recovered from the injury sustained in a car accident earlier this year.

DOWN ARGENTINA WAY : (left) Personnel of Regiments 4 and 6 of the Argentine Air Force, equipped with Gloster Meteor 4s. Twenty-five of their aircraft were recently engaged in the Regiments' first experience of air-to-ground armament practice, with satisfactory results. Below (left) two Meteors are seen taking off at Commandante Espora naval base, from which all flights were made. Targets consisted of white panels floating in the Atlantic, or fixed targets on the sand dunes (lower right). An official Argentine report on the manoeuvres states that "the fact that not even a tyre blew or any part of the armament failed to render expected service speaks well for the builders who supplied the jet-propelled aircraft fleet."





A new "aerial" of de Havilland's prototype four-Ghost Comet.

COMET DISCUSSION

Lines of Development : Sales Policy : Performance and Experience to Date

SEVERAL most important points regarding the Comet were raised and discussed at a recent meeting of the aeronautical Press with de Havilland executives. The occasion marked the official release of the measured performance figures for the prototype aircraft obtained during its first 150 hours of development and test flying. These figures were given in last week's issue of *Flight*.

On the question of future development of the Comet or possible plans for a successor, it was stated that the machine as at present conceived offered many opportunities for development over a period of years, both as a result of airframe and engine advances. Immediate plans included an increase in fuel capacity of several hundred gallons, the new tankage to be located principally in the wing leading-edges. This alteration was not intended to be incorporated in the fourteen B.O.A.C. or two C.P.A. aircraft now on order, but if called for later it could be included in them. As these first aircraft were not intended for service across the Atlantic the additional fuel capacity was not necessary, but any subsequent aircraft for the North Atlantic Prestwick to Gander route would certainly have it. This would give 95 per cent regularity with 24 passengers on the ocean stage.

Regarding the stacking problem at New York's busy airports, it was pointed out that the Gander-Idlewild stage is comparatively short (1,200 miles), and therefore plenty of reserve fuel could be carried, together with the full load envisaged for the longer stage. The time would be cut by about 3½ hrs to 9 hrs (including two 1 hr stops) for the whole journey. However, it was again stressed that the North Atlantic route would not be in mind for the Comet until after it had been introduced on the Empire routes.

Non-stop flights direct from London to New York or return would not be considered unless flight-refuelling was to be used. On this important subject it was learned that the two companies concerned, together with the M.C.A., are giving serious consideration to flight-refuelling at the present time, and B.O.A.C. have not, in fact, decided against its use—nor, for that matter, have they yet accepted it. The transfer of kerosene is considered to be a very different matter from that of petrol, and the reduced fire risk is a most important consideration.

Forecasting development — with some reluctance — Mr. Walker, chief engineer, felt that 120,000 lb a.u.w. was a reasonable possibility for the future and perhaps 110,000 lb fairly soon. Major Halford, chairman and technical director of the de Havilland Engine Company, said that 3 to 5 per cent improvement in fuel consumption was hoped for—this, though it sounds little enough, actually represents a very large advance. An impression was given that ultimately turbojets other than the Ghost might be installed.

Water injection, for which the four Ghosts are equipped, has not yet been used on the prototype Comet, but it will be standard on all production aircraft. It will give about 10 per cent increase in thrust for take-off, i.e., 2,000 lb total for the four Ghosts. Major Halford pointed out that on a well-balanced engine—one with compressor and turbine properly matched—this was as large an increase as could be obtained. Conversely, larger percentage power-increases resulting from water injection were indicative of a poorly-balanced unit.

Sprite rocket motors, of which two were provided for, were under development. These would still further increase take-off thrust, should this be necessary, at such airfields as Nairobi and Khartoum. Sprites are designed each to give 5,000 lb thrust for 9 sec.

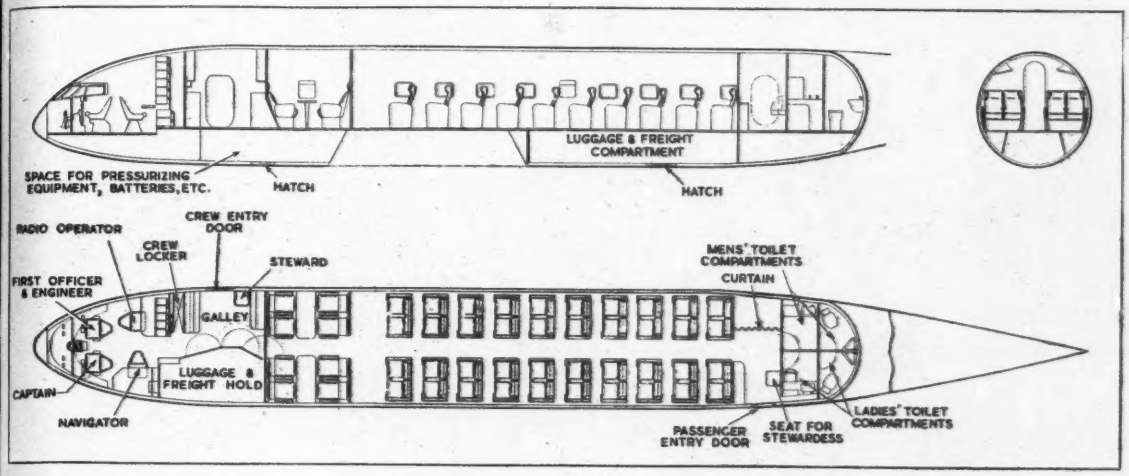
Next year a series of important long-distance flights are to be made. These will take the Comet to representative Empire-route airfields where experience of "high and hot" take-off will be gained.

On the subject of enquiries from foreign operators, the de Havilland executives stated that during the last three months in particular they have been approached by representatives of very many of the world's principal airlines, including the main American companies, but that no serious negotiations for sales have been opened.

Serious Customers

This important release of actual performance figures for the Comet as it is to-day, in first prototype form, will no doubt mark the beginning of serious discussion of sales. New approaches should now indicate which companies are serious potential customers and which were merely being inquisitive for other reasons. Discussions have, in fact, taken place regarding the possibility of building Comets under licence abroad, but no commitments have been made on either side. Before anything of this sort can be considered, important policy decisions must be taken as to whether British (including, of course, Commonwealth) operators should have first call upon, and full benefit from, all the Comet has to offer, or whether Comets should be sold on an open market to all willing to buy them, with a view to bringing into the country at once as much money from sales as possible. If the latter course were adopted it would entail stepping-up production as quickly and by as great a volume as possible, and this might involve the manufacturers in expenditure amounting to several millions—this in spite of the fact that tooling has already been planned with greatly increased production in mind.

No cost price for the Comet has been disclosed, but it was stated that both B.O.A.C. and Canadian Pacific Air Lines had agreed to a "commercial price" based upon the production of a considerable number of aircraft and taking into account the four main items of expense: design, development, tooling and production. Acknowledgement was made of the close co-operation of the Ministry of Supply, not only in regard to the most important order which they had placed for the Comet, but also to their indirect contribution to the cost of the venture, as represented by their share in the development costs of the Ghost military turbojet and the D.H.108 research aircraft.



This 48-seat layout differs from the 36-seat plan (see *Flight* for October 27th) chiefly in having "condensed" rear compartments. The forty-eight paired chairs appear to fit remarkably well into the shapely standard fuselage.

Order of purchase would settle order of delivery and, as things were at present, C.P.A. would get numbers 17 and 18 Comets. However, should the production rate be stepped-up to any great extent as a result of substantial additional orders, it might be possible to meet agreed delivery dates to B.O.A.C. and to complete extra aircraft for other customers at the same time. The M.o.S. has no direct control over Comet sales. The de Havilland Company is, of course, well aware of the urgent need to maintain and exploit the lead which the Comet has established over other aircraft, and which is now estimated to represent three years in time.

Of the Comet's flights to date and its present position, it was stated that the target of 150 hours' flying by the end of the year was, on Wednesday, December 21st within one hour of achievement.

The new bogie landing gear has now been fitted, and has been flown with success. A differential pressure of 2 lb had been tried out to date, and flights at altitudes up to 46,000ft had been made. This did not represent the aircraft's ceiling. Both severe icing and high-altitude turbulence had been encountered without untoward results—the former on the Castel Benito flight as well as on other occasions. It was assumed that no ice must be allowed to form in the intake ahead of the impeller, so all forward surfaces were heated to prevent it.

The interesting point in connection with John Cunningham's encounters to date with severe bumps—one in particular at 35,000ft—has been that sufficient warning has been given in the form of mild turbulence to permit passengers to be told and asked to secure their seat belts.

Although there is no intention of using anything but kerosene, Ghosts have been tried out with petrol as fuel for an emergency, and they ran perfectly satisfactorily. This is in line with the policy for all jet-fighter squadrons. A slight reduction in range would result in the case of the Comet.

Now that impressive, established figures can be quoted for the existing Comet (without allowance for any of the improvements already in mind) it may not be many months before other companies place orders following the B.O.A.C. and B.C.P.A. lead.

FOKKER TRAINER PROGRESS

DURING a recent visit to the Fokker factory at Amsterdam we were able to see and hear something of the progress that is being made with the company's own trainers and with Meteors built under licence. Since the temporary problems regarding the financing of aircraft research, design and development have been settled, the all-metal twin-engined S.13 has been completed and its first flight, from Schiphol, is expected within the next week or two.

It will be remembered that this machine is for pilot and crew training, and normally carries five occupants, although there are eight stations for flying and crew duties. The 600 h.p. Pratt and Whitney radials drive a new type of airscrew with two rounded-paddle blades. Pilots will find that they have a very good view from the large cockpit windows.

The S.13, which sits well off the ground on its long legs, has a span of 63ft, the length is 44ft 7in, height 18ft, wing area 495 sq ft; all-up weight is 12,735 lb. Performance promises to be quite lively, and one foresees the possibility of a variant for taxi and feederline service. Top speed is expected to be about 220 m.p.h., cruising speed 195 m.p.h., and landing speed 69 m.p.h. Full tank capacity is 270 gallons, giving a maximum range of about 1,600 miles.

Fokker's now well-known primary trainers, the S.11 and its nosewheel variant the S.12, are well developed and in production. It is probable that in addition to the home order a number will be built under licence in France—possibly with Argus engines in place of American Lycomings. Electrical intercomm. and V.H.F. radio are to be fitted.

Recently the strength factor of the S.11 and S.12 has been still further increased, and it is now well above that required of the class 3a (limited aerobatic) category in Holland. Stick force is about 10 lb per g.

Work on the clean-cut S.14 side-by-side advanced trainer with a single Rolls-Royce Derwent turbojet also progresses, and the first prototype should be completed next summer.

Meteor components and units are beginning to flow in the factory, and several major overhauls of British-built machines already in squadron service have been undertaken. Some Dutch-built Meteor airframes will also be supplied to the Belgians, who are building the Derwent turbojets for them.

Incidentally, modifications to the extension shaft for the pusher propeller of the F.25 Promoter have been completed and a different propeller is now fitted. It had been found, apparently, that the passage of the v.p. blades past the rear fairing of the engine nacelle was having a detrimental effect upon their bearings.

THE WOMEN'S WAR

"Daughters of Britain," by Vera Douie. Obtainable from the author, 12, Charlbury Road, Oxford. Price 7s 6d.

WRITTEN primarily for the benefit of readers in other countries, though not, in the event, used for the purpose, a comprehensive survey of the varied tasks of British women during the second World War has been made by Miss V. Douie, librarian of the Women's Service Library. From women of the A.T.S. replacing men on A.A. gun sites, and members of the W.A.A.F. in charge of their barrage balloons (to mention only two of the multitudinous jobs of Servicewomen), down to the humble housewife coping with fractious evacuees—all played their part. None is forgotten in this accurately presented picture and the book will serve as a useful reminder of the work of British women at home and overseas.

CIVIL AVIATION NEWS

SWEPT-BACK SHADOW: Futuristic plan-form illusion under a K.L.M. Convair-Liner on the tarmac at Schiphol.

ANTIPODES TRIALS

THE question of obtaining a suitable aircraft for operations on internal routes is causing concern to the New Zealand National Airways Corporation. Following a recent visit to Britain, the chairman of the Corporation, Sir Leonard Isitt, said that he considered New Zealand would be fortunate if such an aircraft were forthcoming within the next three or four years. The Corporation has been investigating possibilities of several types, particularly those of British design, for the last two years.

Handley Page, Ltd., confirm that plans are being made for the Miles Marathon to undergo trials in New Zealand in the near future, and it is understood that other aircraft may also be flying to New Zealand for the same purpose. The chairman's report points out that the Corporation cannot afford to purchase any aircraft if there is a likelihood that it might have to be withdrawn from service for subsequent modifications.

An Australian source reports that the Comet, the Avro jet-liner and the Viscount, together with the Marathon, are all scheduled for early visits to Australia. Qantas is named as a prospective customer for the Comet, which, it is thought, will probably visit all States in the Commonwealth.

FUEL AVAILABILITY

A WEALTH of information on refuelling facilities at airfields and landing grounds throughout the world is contained in the latest edition of the Shell Aviation Service availability list. The booklet has been compiled primarily for the benefit of the non-scheduled charter operator and is designed to be of special assistance to him in flight planning. It shows the availability of aviation fuel and aero-engine oils at a number of major points on the trunk air routes.

Typical of the excellent world-wide service which the major fuel companies are now offering to aviation, the pamphlet should prove particularly valuable to charter and other operators who have to prepare flight-plans for unfamiliar territory.

HELICOPTER REQUIREMENTS

BRITISH civil airworthiness requirements for rotating-wing aircraft are the subject of a new A.R.B. booklet.* Although emphasizing that, in view of the rapid development of helicopter design, the requirements must be considered provisional, the Board thinks that there is now a sufficient background of experience, and sufficient agreement by all concerned on the subject of design standards, to justify the establishment of an airworthiness code.

Basic requirements for performance, handling characteristics, controllability and ground and water manœuvres are detailed, in addition to structural requirements, which include consideration of the loads imposed by gusts and loads in asymmetrical flight.

* *"British Civil Airworthiness Requirements—Section G: Rotorcraft," Air Registration Board, Brettenham House, London, W.C.2. Price 5s.*

CONSTELLATION TRANSFER

PAN American World Airways announce the sale of four new-type L-749 Constellations to Air France. The aircraft were purchased by Pan American in June, 1947, to augment seating capacity pending the receipt of the 20 Boeing Stratocruisers which were on order, and the delivery of which had been delayed. The company expects to take delivery of the last Stratocruiser in the near future, and is now able to dispose of the four Constellations. Pan American emphasizes that it will continue to operate the remaining 14 aircraft of its Constellation fleet, which now serve routes to Europe, the Caribbean, South Africa and the Far East.

The sale will be doubly beneficial to the two lines concerned; the four Constellations were the only ones of the L-749 series operated by Pan American, and thus their disposal will permit greater standardization of maintenance and overhaul operations. The additional equipment will also permit further standardization for Air France, whose Constellation fleet, on the delivery of these aircraft and six more still on order from the factory, will ultimately consist of 19 L-749s. Greater operating economy and a substantial saving in dollars should result from the purchase.

B.E.A. TRAFFIC INCREASES

RETURNS for the month of October indicate that passengers, freight and mail carried by B.E.A. over its 12,500 miles of internal and continental routes show substantial increases over the figures for the corresponding month of the previous year.

Percentage increases are 21.7, 13.6 and 22.5 respectively. Freight shows an increase of more than 40,000 lb on the September, 1949 total, which exceeded 1,000,000 lb for the first time. Most striking percentage increase in the carriage of freight was on the internal United Kingdom services, which was 62.79 per cent more than in October, 1948.

The figure for revenue passenger miles flown was 17,628,933, and 60,548 passengers were carried. The distance flown on all services was 1,209,933 miles, and the number of passenger stage flights completed was 5,538.

NOISELESS NIGHTS

IN response to public complaints against night flying, Lord Pakenham has informed the Mayor of Bournemouth that until the end of next February night flying at Hurn Airport will cease at 10 p.m. and that in future any training on the new types of aircraft will not occur more than three times a fortnight. The Minister said that he could not look further ahead than 1951, but that he would give the earliest information possible to the local authorities concerned if and when it was intended to use jet-propelled commercial aircraft for training at Hurn.

Lord Pakenham added: "From the information at my disposal I cannot accept unreservedly many of these allega-

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tions based, as they are, on visual estimation only." The Minister said that there was no other airfield which, having regard to financial limitations, fulfilled the conditions necessary for carrying out flying training.

ACCIDENT INVESTIGATION

WITH the object of standardizing nomenclature and classifications, and of setting out a logical sequence of investigation, I.C.A.O. has produced a *Manual of Aircraft Accident Investigation*. The manual provides basic information, suggestions and procedures based on the existing methods used by several of the I.C.A.O. contracting States.

The book details fully such aspects as action on the scene of the accident, the collation of evidence from witnesses and technical examination of the aircraft components. Consideration of contributary causes—such as (to mention a few) weather, the human factor and failure of aircraft materials—is dealt with in a comprehensive fashion, and a specimen I.C.A.O. accident-report is contained in an appendix.

Although limited to a presentation of the items of primary importance, the manual should serve as a valuable guide to assist investigators in understanding the broad general principles involved, and to guide them in working out their own systems of procedure.

"STAR ARIEL" LOSS

THE Chief Inspector of Accidents has published his report on an investigation into the cause of the disappearance of the B.S.A.A. Tudor IVB *Star Ariel* while it was flying on the Bermuda-Santiago service on January 17th, 1949.

The aircraft left Bermuda at 1242 hr on a direct flight to Kingston, Jamaica, with sufficient fuel for ten hours. The last message from the aircraft was sent at 1342 hr, reporting that the operator was changing to Kingston frequency. At 1752 hr Kingston originated the first warning and reported that the aircraft had not been in contact with Jamaica since the time of its departure from Bermuda. At 1838 hr G-AGRE was considered overdue and an unsuccessful search followed.

The conclusion of the Investigation Board was that all safety conditions had been satisfied and that there were no weather complications and no evidence of sabotage. The Inspector finds that, through lack of evidence in the absence of wreckage, the cause of the accident is unknown.

SOUTH AFRICA'S CLUBS

A REPORT from South Africa suggests that at least half of the Union's flying clubs will be forced out of existence unless an immediate Government subsidy is forthcoming. The chairman of the Aero Club of South Africa, to which 23

(*continued overleaf*)

BRITISH AIRWAYS' OPERATING STATISTICS FOR AUGUST, 1949

(*Figures for the corresponding period in 1948 are given in parentheses*)

	B.O.A.C. All Divisions	B.O.A.C. Western Division	B.O.A.C. Eastern Division	B.O.A.C. South American Division	B.E.A. All Divisions	B.E.A. Continental Division	B.E.A. British Division
Total revenue aircraft-miles ...	2,457,327 (2,696,535)	354,404 (333,280)	1,706,387 (1,896,984)	396,536 (466,271)	1,721,705 (1,441,883)	1,089,599 (796,941)	632,106 (644,942)
Total aircraft-miles	2,828,908 (3,045,015)	395,437 (491,768)	1,954,457 (2,035,088)	479,014 (518,159)	1,756,212 (1,470,177)	1,108,785 (814,315)	647,427 (655,862)
Revenue passengers carried ...	12,858 (11,918)	3,434 (3,913)	8,255 (6,739)	1,169 (1,266)	103,719 (84,251)	39,636 (25,491)	64,083 (58,760)
Revenue passenger-miles	35,347,033 (36,175,275)	8,109,144 (9,120,127)	25,206,638 (22,999,760)	2,031,251 (4,055,388)	27,048,256 (20,255,011)	16,566,364 (11,517,409)	10,481,892 (8,737,602)
Available seat-miles	57,493,684 (55,799,631)	11,353,321 (14,128,444)	39,681,115 (33,435,721)	6,459,248 (8,235,466)	37,991,077 (27,969,187)	24,411,486 (16,425,629)	13,579,591 (11,543,558)
Revenue passenger load-factor (per cent)	61.5 (64.8)	71.4 (64.6)	63.5 (68.8)	31.4 (49.2)	71.2 (72.4)	67.9 (70.1)	77.2 (75.7)
Cargo carried (tons) :							
Mail	139.8 (150.4)	29.1 (25.2)	96.4 (109.6)	14.3 (15.6)	286.9 (234.3)	180.6 (133.9)	106.3 (100.4)
Freight	308.2 (275.1)	40.4 (39.3)	238.1 (200.4)	29.7 (35.4)	527.2 (479.3)	343.7 (367.1)	183.5 (112.2)
Total revenue load ton-miles ...	5,167,807 (5,180,516)	982,924 (1,039,949)	3,802,192 (3,463,734)	382,691 (676,833)	2,584,165 (1,982,871)	1,719,056 (1,268,621)	865,109 (714,250)
Total usable capacity ton-miles ...	9,947,320 (8,632,099)	1,732,344 (1,738,402)	6,657,461 (5,475,064)	1,557,515 (1,418,633)	4,046,472 (3,039,297)	2,797,506 (1,930,977)	1,248,966 (1,108,320)
Overall revenue load-factor (per cent)	53.8 (60.0)	57.9 (59.8)	57.5 (63.3)	29.4 (47.7)	64.5 (65.3)	61.8 (65.7)	70.7 (64.6)
Total revenue hours...	12,453 (14,493)	1,579 (1,420)	8,893 (10,772)	1,981 (2,301)	11,714 (10,166)	6,487 (4,774)	5,227 (5,392)
Total non-revenue hours	2,088 (1,980)	212 (839)	1,457 (856)	419 (285)	272 (262)	132 (107)	140 (99)
Equivalent annual utilization (revenue hours) per aircraft ...	1,377 (1,430)	— —	— —	1,266 (1,355)	1,497 (1,601)	1,614 (1,784)	1,375 (1,469)
Unduplicated route miles in operation at end of period	79,950 (88,913)	7,700 (8,523)	52,493 (55,503)	19,757 (24,887)	13,961 (13,683)	11,126 (11,134)	2,835 (2,549)
Percentage regularity	98.8 (99.0)	94.6 (99.7)	99.9 (99.2)	97.9 (97.6)	98.1 (97.9)	98.2 (99.2)	98.1 (97.5)
Average length of stage flight (miles)	1,030 (966)	1,107 (1,104)	1,030 (926)	964 (1,055)	198 (179)	355 (392)	114 (112)

THE total of passengers carried by the British Airways Corporations and B.E.A.'s associated companies during August, 1949, was 133,000 greater than the figure for the corresponding month of last year; passenger mileage increased by 13 per cent. Although there was only a small increase in the aircraft-miles and mail ton-miles flown, the figure for freight ton-miles flown during the month rose to 1,448,000, an increase of 11 per cent over August, 1948.

B.E.A. carried more passengers in August, 1949, than in any previous month, and flew 27 million passenger-miles. On the continent, 17 million passenger-miles were flown, 44 per cent more than in August, 1948, and more than double the figure for August, 1947. The traffic of B.E.A.'s associates showed little change compared with July, 1949, but the overall revenue load-factor rose from 57 per cent to 61 per cent.

B.O.A.C.'s traffic, which included that on the routes formerly operated by B.S.A.A., showed a slight decrease on the combined figures for the two Corporations in August of the previous year. There was a marked decline of traffic on the South American Division routes, but load ton-miles flown on the Eastern and Western Divisons, which correspond to B.O.A.C.'s total operations before the merger, rose to 4,785,000, an increase of six per cent over the traffic carried on these routes in August, 1948.

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of the clubs are affiliated, has asked for assistance to the extent of £50,000 for the first year, increasing by £5,000 increments to £65,000. This would reduce the cost of flying from £3 10s to a figure between £1 and 30s per hour and result in a larger pool of potential military and civil pilots.

In return for the subsidy, clubs would undertake to train 300 "A" Licence pilots per year, and assist currently-licensed members to maintain the validity of their licences.

PILOTS' PENSIONS

PILOTS employed by the British airline corporations will benefit by a pension-scheme agreement negotiated on their behalf by B.A.L.P.A. The final draft has yet to be approved by the Minister of Civil Aviation and by the Board of Inland Revenue.

Major implications of the scheme are that membership will be compulsory for all pilots under 35 engaged after the passing of the Civil Aviation Act, and will be effective from the date of appointment as pilot. A minimum pension payable is £350 at the age of 40 and a maximum of £650 at the age of 50. The minimum age for retirement is 40, subject to ten years' service as a pilot, but retirement before reaching the age of 45 is permissible only with the agreement of the corporation concerned.

Pilots who retire before reaching the minimum pension age because they cannot retain their licences owing to ill-health or accident will receive a pension based on age and length of service. The death benefit payable if a pilot is killed in a flying accident will be four times his basic annual salary.

B.O.A.C. pilots who are in the Corporation's existing pension scheme will now have the option of transferring.

BRITISH AIRWAYS STATISTICS FOR APRIL, 1948 TO MARCH, 1949

(Comparative figures for financial year 1947/48 are given in parentheses, together with percentage change.)

Services	Revenue Aircraft-Miles Flown	Revenue Passenger-Miles Flown	Available Seat-Miles Flown	Revenue Passenger Load-Factor	Revenue Passengers Carried	Revenue Cargo Carried (Tons)		Revenue Ton-Miles Performed (Total)	Usable Capacity Ton-Miles Flown	Overall Revenue Load-Factor
						Mail	Freight*			
British European Airways§	12,786,907 (12,465,434) +2.6	155,027,743 (122,475,237) +26.6	237,770,934 (176,718,077) +34.5	65.2 (69.3)	577,122 (511,522) +12.8	2,663.2 (1,390.9) +91.5	4,800.2 (3,022.7) +58.8	16,468,327 (12,304,122) +33.8	26,275,607 (19,738,675) +33.1	62.7 (62.3)
British Overseas Airways	25,772,196 (24,457,607) +5.4	362,101,251 (296,908,288) +22.0	546,073,753 (445,534,216) +22.6	66.3 (66.6)	120,334 (101,170) +18.9	1,709.2 (1,692.3) +1.0	3,247.7 (2,087.4) +55.6	53,476,140 (42,354,634) +26.3	86,401,049 (63,895,569) +35.2	61.9 (66.3)
British South American Airways	5,121,442 (4,795,786) +6.8	47,538,862 (50,048,507) −5.0	94,032,348 (92,061,102) +2.1	50.6 (54.4)	21,005 (13,772) +52.5	209.8 (170.1) +23.3	600.8 (553.4) +8.6	8,593,878 (8,804,840) −2.4	16,192,689 (14,955,559) +8.3	53.1 (58.9)
Total Internal Services†	5,187,254 (7,046,449) −26.4	57,496,560 (49,370,589) +16.5	90,434,759 (77,707,451) +16.4	63.6 (63.5)	369,722 (360,131) +2.7	1,175.1 (791.6) +48.4	1,213.7 (988.3) +22.8	4,930,494 (4,103,378) +20.2	8,579,981 7,642,670) +12.3	57.5 (53.7)
Total International Services	38,493,291 (34,672,378) +11.0	507,171,296 (420,061,443) +20.7	787,442,276 (636,605,944) +23.7	64.4 (66.0)	348,739 (266,333) +30.9	3,407.1 (2,461.7) +38.4	7,435.0 (4,675.2) +59.0	73,607,851 (59,360,218) +24.0	120,289,364 (90,947,133) +32.3	61.2 (65.3)
Total All Services	43,680,545 (41,718,827) +4.7	564,667,856 (469,432,032) +20.3	877,877,035 (714,313,395) +22.9	64.3 (65.7)	718,461 (626,464) +14.7	4,582.2 (3,253.3) +40.8	8,648.7 (5,663.5) +52.7	78,538,345 (63,463,596) +23.8	128,869,345 (98,589,803) +30.7	60.9 (64.4)

* Includes excess baggage and diplomatic mail.
† Excludes U.K./Continent services operated by B.E.A. English and Scottish Divisions (included in international services).
§ B.E.A. figures for 1948-9 include a number of special freight services.

THE statistics above are extracted from the final returns of the three British Airways Corporations—B.E.A., B.O.A.C. and B.S.A.A.—for the financial year ended March 31st, 1949. They supplement the annual report of the Corporations published in *Flight*, October 20th. The figures include B.O.A.C.'s share of the pooled traffic on the U.K.-Australia and U.K.-South Africa services operated jointly with Qantas Empire Airways and South African Airways respectively. The operations of the subsidiary and associated companies are excluded, but regular scheduled services which were temporarily operated by charter companies on behalf of the Government are regarded as Corporation services.

BREVITIES

A NEW Atlantic record is claimed by Pan American World Airways for a Constellation flight from New York to Shannon, on December 18th, in 7 hr 49 min, an average speed of 395 m.p.h. The present record is 8 hr 25 min, which was set up by a B.O.A.C. Constellation on December 2nd, 1946.

* * *

So great were the demands for air travel during the Christmas holidays that 71 extra flights were scheduled by B.E.A. between December 19th and 31st. The main destinations were Paris, Switzerland, Channel Islands and Northern Ireland. To relieve pressure on the Continental freight department, four Halifaxes of the Lancashire Aircraft Corporation were chartered for flights from London to Athens.

* * *

Further details of the reduced return fares which, subject to international approval, will be offered by American trans-Atlantic airlines during the first three months of 1950, have been announced by I.A.T.A. Some examples of the new rates from New York include: To London, £137 10s (a saving of £87 10s); to Amsterdam-Brussels-Paris, £145 10s (£92 10s); to Copenhagen-Oslo-Frankfurt-Zurich, £158 (£84 10s.); and to Rome, £173 (£107 10s). The B.O.A.C. New York-London fare is £125.

* * *

Extension of existing routes and the inauguration of a new direct service to Britain will be the result of the purchase of four Constellations, recently concluded by South African Airways. The South African Minister of Transport has stated that the present Nile service will be extended to include a stop at Rome and, possibly, stops at Cairo and Athens, while a new route would be operated *via* the West Coast of Africa direct to Britain. A service to the United States may be introduced as soon as it is economically feasible.

* * *

Following a successful trial flight by an African Airways Corporation aircraft, it is announced that a link between Accra and Khartoum will be inaugurated on January 6th. The new service will provide connections with other airlines at Accra westwards to the United States and at Khartoum for destinations in Asia. A Bristol Wayfarer which made the trial flight carried 16 first-class and 12 second-class passengers, with 1½ tons of freight.

* * *

The television sound transmissions from Alexandra Palace on 41.5 mc/s are said to be causing interference with S.B.A. reception in aircraft flying in the London area. In *Information Circular No. 141*, the Ministry of Civil Aviation states that interference has so far been reported only on aircraft equipped with marker beacon receiver R.1125D using a horizontal wire aerial capacitively coupled to the grid circuit of the first valve, and can be cured by modifications to the receiver.

* * *

A new arrangement of connections enables B.C.P.A. passengers flying between the Antipodes and the United Kingdom to do so in an elapsed time of only 78hr. Passengers from Sydney connect at San Francisco with United Airlines' DC-6 service to New York and then with the B.O.A.C. Constellation service to London. The through fare is £NZ270 or £Aus325. Stop-overs may be made at any point with no additional charge. An alternative routing is available *via* Canada, calling at Vancouver and Montreal.

According to an American Airlines report one of the chief reasons for the present financial difficulties of the U.S. airline industry is that too many separate lines are operating on the same routes. The company has urged the C.A.B. to reject requests for permission to fly on routes already covered by its own flights.

* * *

The original condition that firm bookings could not be made more than seven days ahead at the specially reduced fares for serving members of H.M. Forces travelling by B.E.A. to London and certain overseas stations has been rescinded. Such bookings will now be given definite seat reservations however far ahead they are made.

* * *

An analysis of the Air Registration Board's Register of British Civil Aircraft as at December 12th, 1949, shows that of a total of 1,960 British and foreign aircraft listed, 584 are owned by taxi and charter firms, 334 by clubs and training schools and 252 by private owners. Aircraft which are privately owned by commercial companies number 265 and of the remainder 252 belong to State-owned corporations.

* * *

A second large airport, to be reserved exclusively for civil transport, is to be built at Houston, the largest city in Texas. The United States Civil Aeronautical Administration has offered to contribute a large proportion of the six-million-dollar cost. The present airfield, used by both military and commercial aircraft, has become so overcrowded that one important airline recently moved its headquarters from Houston to Dallas.

* * *

The Hong Kong assets of the China National Aviation Corporation and the Central Air Transport Corporation have been purchased by General Claire Chennault and Mr. Whiting Willauer, president and vice-president respectively of the Civil Air Transport Company. The purchase is said to have been made with the authority of the Nationalist Government of Free China. The United States State Department has declined to comment on the purchase until it has received further reports on the situation from American diplomatic sources in China.

* * *

From nominations by each of the 55 member-nations of I.C.A.O. six persons are to be selected for a five-month training course at I.C.A.O. headquarters, Montreal. Nominations must be received by January 16th, 1950, and the course will begin on February 20th. Apart from instructing trainees in the workings of I.C.A.O., the programme is intended to give an opportunity to aviation specialists for advanced study and participation in the work of the organization in their own particular fields of interest.

REFLECTIVE MOOD: A B.O.A.C. Argonaut is attractively mirrored after a summer storm at the Kai Tek Airport, Hong Kong.

Air France statistics show that 1949 has broken all previous annual records for the number of passengers carried by the company in and out of London Airport. It is estimated that the increase over the figure for 1948, which was itself a record, will prove to be in excess of 43 per cent. During July, August and September a daily average of 400 passengers was handled. Skymasters, with 55 seats, were introduced on the London-Paris route to supplement the capacity of the 33-seat Languedocs.

FROM THE CLUBS

THE Ultra-Light Aircraft Association announces that its president, Mr. Peter Masefield, is presenting a trophy to be competed for by affiliated groups and clubs. It will be awarded annually to the group or club which has shown the greatest efficiency and enterprise, both in the air and on the ground, during the preceding 12 months. The governing regulations will be so framed that safety and reliability records will play a prominent part in deciding the annual winner.

The resignation of Mr. H. N. Rose-Dale from the chairmanship of the U.L.A.A. construction sub-committee and from the executive committee is announced. He will be succeeded by Mr. C. W. Pitt, an aircraft constructor of considerable experience.

A project to instal a 350 c.c. motor cycle engine as a retractable pusher power plant in a Scud III sailplane is now reported to have been successfully completed. The owner, Mr. R. Swinn of the London Gliding Club, has flown the aircraft for about 100 hr up to a maximum height of 5,200ft, and says that it is extremely simple to operate. His longest flight so far has been of 7½ hr duration, and the addition of the engine apparently makes no difference to the fore-and-aft trim.

The fitting of a specially converted 250 c.c. Villiers engine to the original Scud III was intended to provide a means of launching a sailplane, and climbing to the height required for soaring, without the expense and complication of a tug or a launching winch. Once at height, the engine was stopped and retracted into the fuselage so that the sailplane could achieve its maximum soaring performance. When desired, the engine could be wound out again and started from the cockpit.

Besides fitting the more powerful engine, Mr. Swinn has altered the original installation-design completely. The unit is mounted in the neck-fairing behind the wing and is attached by means of three bolts. The retracting gear consists of a simple leadscrew, along which travels an actuating arm connected to the engine mounting. The leadscrew is driven by a chain passing round a sprocket at the side of the fuselage and forward to a simple 45-deg bevel drive and handle. The engine used by Mr. Swinn is an inverted 349 c.c. two-stroke Villiers, with a thrust-race mounted immediately in front of the 3ft 6in pusher propeller.

The Association announces the affiliation of three new groups, the Montgomeryshire U.L.A. Group, Private Flying (Ipswich), Ltd., and the Wycombe Flying Club.

Amongst the other groups flying was considerably restricted by bad weather during November, but the Cardiff group managed to complete 15 hr in its Tipsy; and Doncaster flew 4½ hr in their B.A. Swallow and newly acquired Piper Cub.

* * *

WEST Riding Aviation Centre reports that it has received M.C.A. approval for its private-pilot training syllabus. During November flying was again curtailed by bad weather, only 12 hours being logged. One member, however, made his first solo.

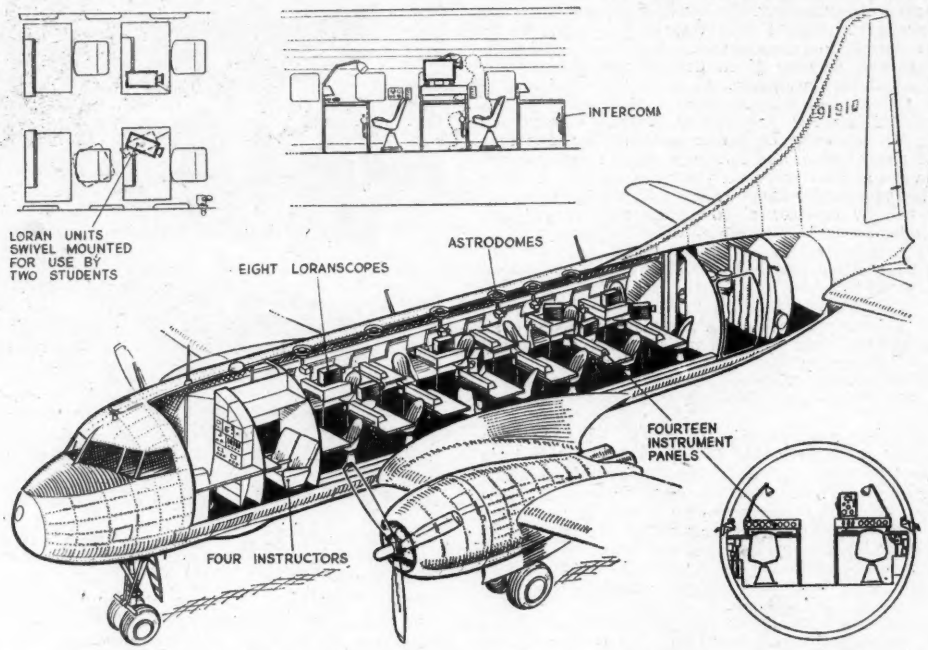
* * *

DERBY Aero Club held a very successful annual ball on December 2nd, and was fortunate in once again having Burnaston House to provide the appropriate atmosphere. Some 200 members and guests reacted in fine style and the affair was unanimously voted even more successful than its predecessors.

As at most other clubs, flying activities are at their minimum at this time of the year, and emphasis is therefore being placed on social activities and ground training. A series of lectures and films on technical subjects, arranged with the co-operation of Rolls-Royce, Ltd., and the Shell-Mex Film Unit, showed a gratifying attendance.

NEW "FLYING CLASSROOM" for U.S.A.F.

The Convair T-29, Specially Adapted for Mass Navigational Training



Navigational classroom: Cabin layout of the Convair T-29 twin-engined navigational trainer developed from the Convair-Liner civil transport. It accommodates 14 students, four instructors, and a crew of three.

IN last week's issue, Stanley H. Evans, F.R.Ae.S., A.F.I.Ae.S., reviewed five types of piston-engined basic trainer designed to U.S.A.F. requirements, and on this page he completes his survey by a description of an aircraft in a somewhat different category—the Convair T-29, for mass training of student navigators; reference to a bombing-trainer variant is also included.

A BRIEF preliminary note on this twin-engined navigational trainer now undergoing flight testing will wind up our numerical line-up of the U.S.A.F. trainer field. A flying classroom fully equipped for the mass training of student navigators, the T-29 is a military conversion of the Convair-Liner civil transport, to which it is externally similar, except for the addition of four transparent plastic astrodomes located in line atop the fuselage for taking celestial sights. It can also be distinguished from the transport by a radome blister beneath the fuselage just forward of the wing and by several "clothes-lines" of external radio antennae. Power plant is also similar to that of the Convair-Liner.

Interior furnishings comprise individual seats and working desks for 14 students arranged in two ranks along each side of the cabin; each trainee has access to complete navigational equipment consisting of Loranscope, duplicate instrument panel, drift-meter, and radio compass. Seats and fold-down tables for four instructors occupy the forward part of the cabin. On the operational side of the roster, a crew of three is provided—pilot, co-pilot and crew chief, making a total of 21 persons altogether. In addition to navigational training, the T-29 will also be used for twin-engined pilot and flight-engineer instruction.

The prototype T-29—unlike its civil forebear, the Convair-Liner—is not pressurized, the idea being to provide students with experience in the use of oxygen masks for high-altitude operation; sufficient oxygen is provided for six hours' duration at the tactical operating altitude of 20,000ft. The elimination of the pressurizing equipment saves about 1,100 lb in the weight empty. Apropos which it should be remarked that the quoted specification weights and performance are estimated and, accordingly, subject to the usual ups and downs as flight testing continues.

Bombing Trainer

The missing number in the Air Force Training stable was planned as the T-32 bombardier trainer version of the Convair-Liner, but whether a prototype has actually been ordered we are unable to confirm at this time. Because of the bomb-aiming stations in the nose, bomb bays, etc., the T-32 is obviously a much bigger conversion job than the T-29. Preliminary design sketches released a year ago by Convair showed provision for a bombardier-instructor and student in a plastic bomber-type nose forward of the pilots' cockpit, and two bomb bays fore and aft of the wing roots with accommodation for 7,200 lb of practice bombs. Installed in the cabin itself were stations for three student bombardiers, complete with aerial cameras for recording bombing results and with radar repeater-scopes for radar bombing observation.

Convair have a current order for 48 T-29s and it is known that the bidding in this class was especially keen in competition with the Martin 2-0-2 conversion proposal. One pertinent reason for that, of course, is that both civil transport versions have so far meant losses of money for their respective manufacturers, both of whom gambled on a much bigger post-war twin-engined market. It looks as if Convair—with the help of Uncle Sam—now have a sporting chance to recoup at least part of their loss in the twin-engined airliner class.

STANLEY H. EVANS.

CONVAIR T-29

Power Plant.—Engines: Two Pratt and Whitney R-2800-CA18 Double Wasp 18-cylinder twin-row radials; normal dry rating 2,100 h.p. at 2,800 r.p.m. at 3,000ft; take-off power (s.l.) (wet) 2,400 h.p. at 2,800 r.p.m. Airscrews: Hamilton-Standard or Curtiss electric, auto-feathering, reversible, 3-bladed, 13ft 1in diameter. Tankage: fuel 1,460 U.S. gal; oil 54 U.S. gal.

Dimensions.—Span 91ft 9in; length 74ft 8in; height 26ft 11in; wing area 817 sq ft; aspect ratio 10.3.

Weights and Loadings.—Gross weight 41,577 lb; weight empty 27,345 lb; useful load 14,232 lb; wing loading 51.0 lb/sq ft; power loading (take-off) 8.7 lb/h.p.

Performance.—Stalling speed (37,000 lb) 87 m.p.h.; cruising speed 250 m.p.h. at 20,000ft; maximum speed 323 m.p.h. at 13,500ft; initial climb 2,130ft/min; service ceiling (2 engines) 28,600ft, (1 engine) 15,000ft; take-off run (over 50ft obstacle) 2,940ft; landing run (over 50ft obstacle) 2,020ft; maximum range, 2,550 miles; endurance 10.2 hours at 250 m.p.h. at 20,000ft.

"Flight" photograph.

The S.B.A.C. Show at Farnborough, 1949 : outstanding event of an outstanding year.

THE YEAR PAST

Looking Back on 1949 : A Turning-point in British Aviation Progress

IN recent years it has been *Flight's* practice to summarize the aeronautical events and developments of the previous twelve months, providing thereby a compact, permanent record of progress. The custom has, during this post-war recovery period, often been a less pleasing reminder of the delays and disappointments which can beset the best of ambitious plans. This time, however, the accent has been on success, and in later years many will come to regard 1949 as one of the most fruitful and encouraging years in British aviation. For other countries, too, 1949 was eventful.

Before attempting a brief analysis of technical, commercial and military developments under their separate headings, it is of interest to trace the sequence of less-clearly classifiable occurrences which have also contributed to the satisfactory pattern of 1949 in retrospect.

Early in the year—on January 11th—came an inspiring ceremony at Derby, when the Rolls-Royce Memorial Window, commemorating the Battle of Britain, was unveiled by the Chief of the Air Staff. Outstanding achievements in the field of high-altitude and high-speed flying were marked by the announcement of Royal Aero Club awards to two de Havilland test pilots, John Cunningham and John Derry. For his part in relieving marooned lighthouse-keepers the previous year, helicopter pilot Alan Bristow received a R.Ae.C. Silver Medal.

Technical achievements were reflected in a number of lectures, notably Latimer-Needham's *Refuelling in Flight*, Rowe's *Helicopter Operations*, and Jones' study of radar and the weather. Two of the major lectures given in February dwelt on transport—Sir Frank Whittle discussed short-range jet airliners, while Major Mayo's paper centred on the effect of records. An important military achievement in that month was the 607-m.p.h. flight across America by the Boeing XB-47 jet bomber.

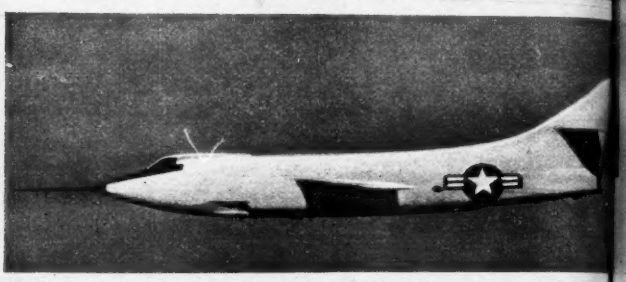
At the beginning of March, a Boeing B-50 of the U.S.A.F. made history by completing a non-stop global flight; British flight-refuelling equipment made the feat possible. Another American long-range record—for light aircraft—was set up by Capt. Bill Odom, who later in the year met a tragic death in the U.S. Air Races. In Britain, lengthy debates were held in both Houses on the pertinent problem of air defence, and four Royal Aeronautical Society lectures on air safety were delivered. The first R.F.C.-R.N.A.S. reunion, at the end of March, was warmly supported.

April, 1949, will be a highlight in the annals of the Guild of Air Pilots and Navigators, for during that month H.R.H. Princess Elizabeth was installed as Grand Master of the Guild. Royal encouragement of, and interest in, aviation was proved on several occasions during the year, among which were the granting of the Royal Charter to the R.Ae.S. in February, and the Queen's consent to becoming Honorary Air Commodore of No. 600 Squadron, R.Aux.A.F. Early in April came a foretaste of the year's excellent progress with Britain's transport aircraft—the successful first flight of the Armstrong Whitworth Apollo. The 18th Paris Salon, which opened at the end of the month, showed that the French aircraft industry had made considerable strides since the 1946 autumn Show in Paris, although the large number of prototypes indicated some degree of wasted effort. Many promising types were demonstrated at the Orly flying display a few weeks later.

At home, the air display season began on Easter Bank Holiday at Elstree, closely followed by the Woodford air show, organized by No. 613 (City of Manchester) Squadron, at which the speedy Hawker P. 1052 made an impressive debut. Refreshingly different from most of the summer shows was the R.Ae.S. garden party at White Waltham, where "vintage" machines were predominant. Proof that British aviation disregards superstition was afforded on Friday, May 13th, by the first flight of the magnificent English Electric Canberra, and by successful completion of three Hawker record attempts within two days: T. S. Wade, in the P. 1052, crossed from London to Paris in 18 minutes; and Neville Duke flew the piston-engined Fury to Pakistan *via* Rome, establishing two records en route. A welcome visitor from America during May was *The Turtle*, record-holding Lockheed Neptune patrol bomber, its flight marking the 30th anniversary of the first West-East Atlantic crossing. M. Dollfus's spectacular balloon ascent from Chelsea was another reminder of the past.

At the beginning of June, the Anglo-American technical symposium was in full swing. Proof of international co-operation was also to be had at Evere, near Brussels, where the air forces of four friendly nations, the R.A.F. among them, helped Belgium to celebrate the 35th year of her air arm in the best aerobatic traditions. Later in the month came another anniversary, when the entire industry honoured Handley Page, Ltd., after 40 successful years of design and production.

During the summer, new equipment and technique, developed by Flight Refuelling, Ltd., kept this Meteor airborne for twelve hours.



(Top) One of the most successful American service aircraft was the Boeing B-50 bomber. This type made the first non-stop global flight and also played an important part in our own air exercises. U.S. supersonic research is illustrated by the Douglas Sky-rocket.

THE YEAR PAST . . .

The last week of June saw another eventful Northern Heights model meeting, and the beginning of two large-scale and highly effective Service exercises—code-named *Foil* and *Verity*. In these manœuvres, together with the autumn bomber exercise (*Bulldog*), members of *Flight's* staff were enabled to participate in, and report on, daylight bombing from 35,oooft, head-on attacks in a Meteor 7, tactical strikes in Fireflies and Lincoln night raids.

The increased scale of air activity inevitably occasioned by the summer months was further apparent in July. There were air rallies in Spain and France, several air displays each week-end, Naval air days . . . the pace had probably never before been exceeded in this country. News which acted as a national tonic came in August—the completely successful maiden flight of the D. H. Comet. At Cowes, construction of Britain's "flying ship," the first Saunders-Roe *Princess*-class S.R. 45 was well under way.

Then came two important "National" events—the Air Races and Gliding Contests. It was unfortunate that, during the best British summer for many years, climatic hindrances should have affected the flying on both occasions. Nevertheless, the Air Races demonstrated not only the excellence of British aircraft and piloting skill, but—also important—a deep popular interest in aviation. Many lessons were learned, and next year's Races will be watched with close attention. The excellent sport of gliding also shows signs of expanding popularity, as witness the recent announcement of increased A.T.C. gliding facilities and the formation of an R.A.F. gliding and soaring association.

Widely differing types of aircraft, finished in racing colours, flew in the National Air Races at Elmdon last August.

September brought two of the year's greatest events: the long-awaited first flight of the mighty Bristol Brabazon, followed by the unsurpassed S.B.A.C. Show at Farnborough, with its inevitable crop of surprises but remarkably few disappointments. On Battle of Britain Day came the traditional fly-past over London and other parts of the country (in the almost traditional bad weather), and the commemorative week was concluded by the customary air displays at many R.A.F. stations, and the service at Westminster Abbey.

The scale of the Berlin Air Lift had been progressively reduced since the lifting of the Russian blockade earlier in the year, and the final flight was made on October 6th, by the R.A.F., the U.S.A.F. having ceased "lifting" a week earlier. Two noted civil concerns celebrated anniversaries about this time—K.L.M. (30 years) and Airwork (21). Pioneer British jet-propulsion development was recalled by the presentation of two early Power Jets turbines to Britain (late in October) and America, early in November; at the same time, modern progress was exemplified by the Comet's startling proving-flight to Africa, and return to London the same day.

In high-speed research, America still held the lead, and no fewer than four separate designs were reported to be capable of supersonic level flight. Lincoln was the fitting scene of a deeply moving ceremony on November 17th, when Rolls of Honour, containing the names of 21,000 Bomber Command aircrew lost during the war, were consigned to the Cathedral.

The progress of the year, also, has not been won without loss, and justifiable satisfaction must be tempered by thoughts of several test pilots, together with civil and Service casualties, who have given their lives in undertaking the exacting and dangerous duties on which achievement is founded.

CIVIL AIRCRAFT

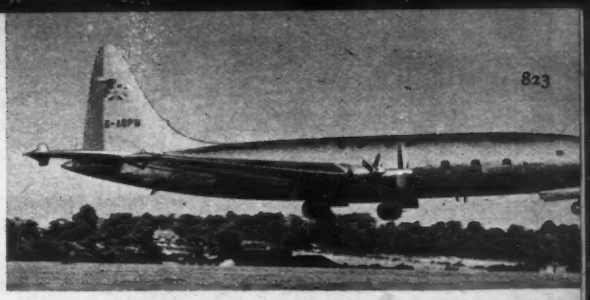
AS the year draws to a close, there is every reason to claim that Britain now possesses the finest civil transport prototypes in the world. For this we may thank the industry's perseverance in the slow post-war process of evolving revolutionary new aircraft, and the wise support of the Ministry of Supply. Particular foresight was shown by the Ministry in shaping the turbojet and turboprop development programme, around which is woven the whole pattern of success.

Justifiable pride should not, however, breed complacency. As yet, we have seen but the dawn of the new transport era, and abundant problems lie ahead. The first flight of the majestic Bristol Brabazon and its subsequent encouraging progress, for instance, were only the beginning of a long and involved series of flight trials, linked with development of the Proteus turboprops with which, it is confidently hoped, the aircraft will operate with profit.

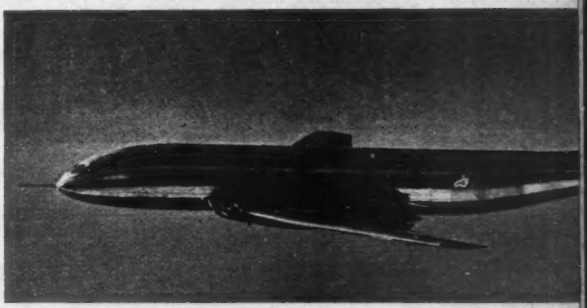
An even more exacting test-programme was embarked upon by de Havillands with their outstanding pure-jet Comet. This prototype, which first flew in August, has been watched with close interest the world over. Its progress to date occasions optimism; speeds in excess of design estimates at high altitudes have been attained, and a record-breaking return flight to Tripoli successfully completed. Production is progressing, and a second prototype will be ready next year; B.O.A.C.'s Comets are likely to begin service on the Empire routes. The Canadian Jetliner first flew shortly after its D.H. counterpart, and has already interested many short-range airline operators.

Exceptional also are the British turboprop transports. Among them, the Vickers Viscount continued to demonstrate smooth and trouble-free flying throughout the year, while B.E.A. announced an order for the larger Viscount 700 production version (powered by 1,400 h.p. Darts). Comparable in conception and quiet, speedy operation is the Armstrong-Whitworth Apollo, powered by four axial-flow Mambas, which first flew in April. Its design was seen to incorporate fully the latest I.C.A.O. requirements, and there were soon reports of likely overseas orders. Theseus turboprops power the 40-passenger Hermes V, which made its initial flight a few weeks before the S.B.A.C. Show, and is a contender for intercontinental airline service. A Hercules-engined variant, the Mk IV, was already in production for the B.O.A.C. Empire routes. The Bristol 175, details of which were announced during the year, is intended as a Constellation replacement, and will take either Centaurus or Proteus power units. Handley Page (Reading), Ltd., began production of the Marathon I feederliner (four Gipsy Queens) for B.E.A. internal routes, and also flew the lively Mamba-powered Marathon II.

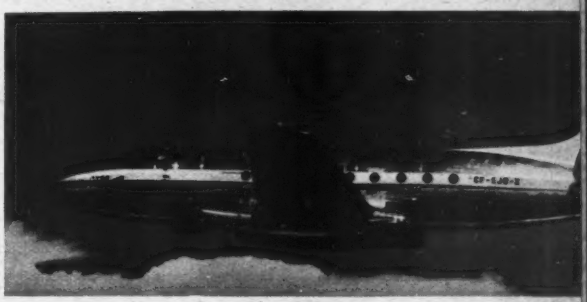
(*Continued after special "1949" drawing overleaf*)



September: the impressive maiden flight of the Brabazon.

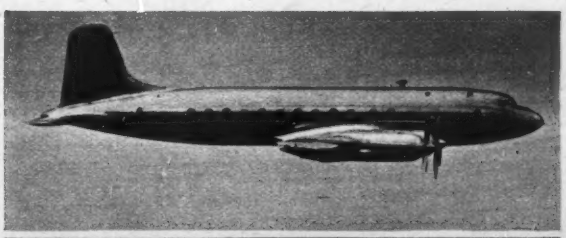


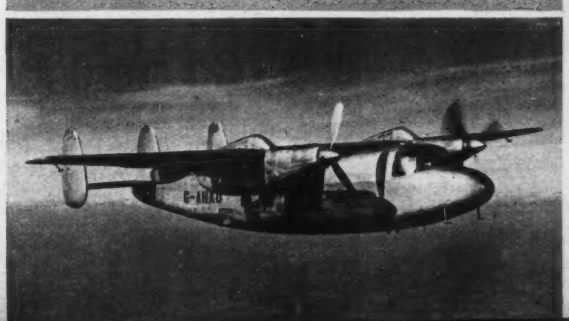
D. H. Comet—the world's first jet airliner first flew in August.



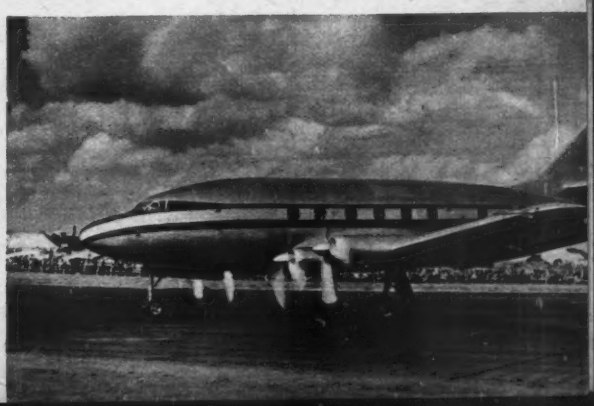
Another 1949 model, the Avro Canada Jetliner.

Completing the quartet are the largest and smallest of the turbine airliners: Hermes V (top) and Marathon II.

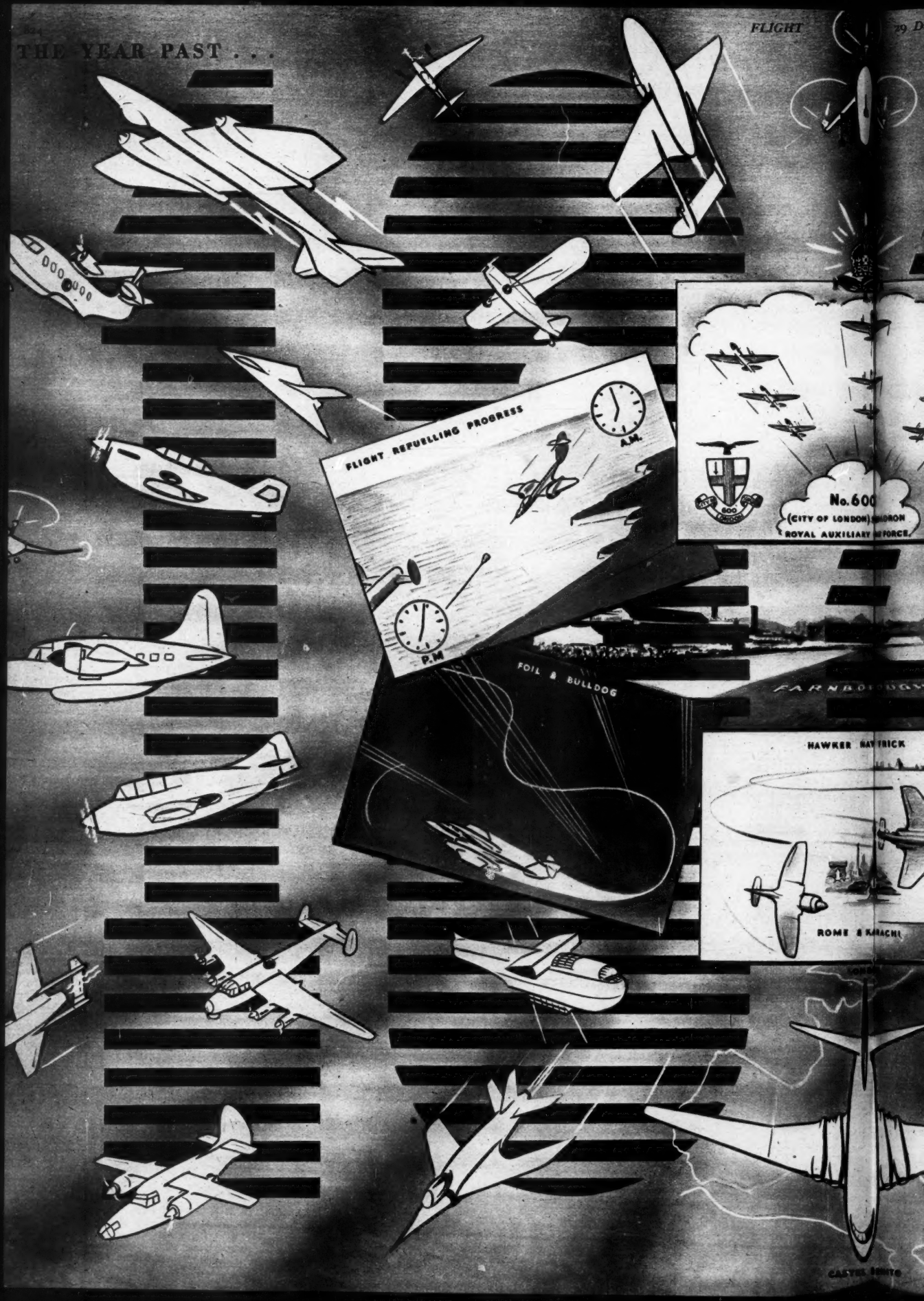




Britain's turboprop transports, together with the pure-jet Comet and the Canadian Jetliner, are unrivalled among the world's airliners. The Viscount, shown above in prototype form, will be built for B.E.A.; and overseas interest in the Apollo (below) was manifest.



THE YEAR PAST . . .



"GOOD-BYE GATOW"
HELICOPTER NIGHT MAIL
CHARLE SARGEANT

THE YEAR PAST . . .

Considerable interest was attracted at Farnborough by a new survey version of the Percival Prince ten-passenger feederliner. Two "workhorses" which deserve mention for consistently reliable, if unspectacular, service are the Vickers Vikings of B.E.A., Airwork and other concerns, and the ubiquitous Bristol 170 Freighters and Wayfarers. A newer piston-engined design, the handsome high-wing Ambassador, remainded the object of development in preparation for its forthcoming introduction on B.E.A. Continental services. Wing-strength and cabin-pressurizing tests were successfully concluded towards the end of the year, and the two Ambassador prototypes were uneventfully but fruitfully employed on progressive altitude flying and power-plant (Hercules 631 and 661) development.

Production of both Solent flying boats and Sealand amphibians progressed at the Belfast works of Short Brothers and Harland, Ltd., while at Cowes the great hull of the S.R. 45 Princess was moved from its building stocks.

Development of existing types, with an accent on their potentialities in utility roles, rather than the introduction of new designs, was the keynote of rotating-wing activity in 1949. A similar trend characterized the light aircraft sphere, and interest has been aroused by new versions of the well-tried Auster and Chrislea series.

The first of three Saunders-Roe Princesses, giant flying-boats for B.S.A.A., reached an advanced stage of construction during the year.

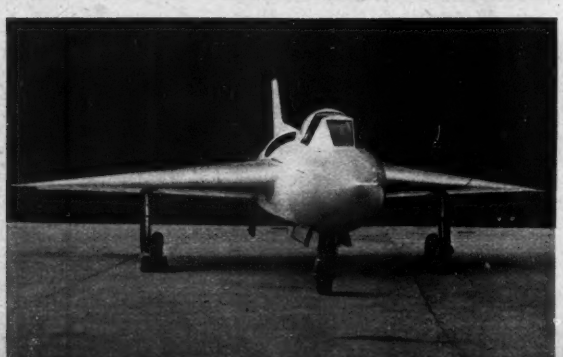
MILITARY AND RESEARCH AIRCRAFT

REQUIREMENTS of national security preclude a full exposition of design and development work on military aircraft during the year. Nevertheless, sufficient evidence has been publicly available of many definite advances.

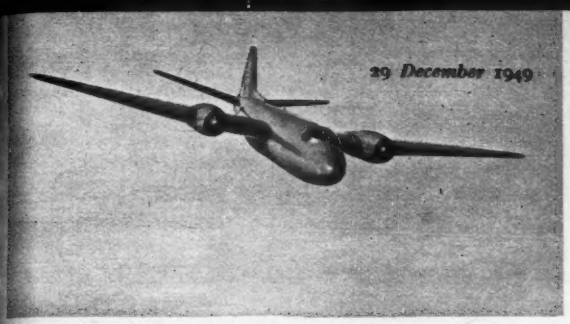
Air exercises showed that the standard squadron fighters —Meteors and Vampires—were well entrusted with the immediate and primary problem of air defence, particularly at high altitude. Retaining the low wing-loading and—apparently—the exceptional docility of the Vampire, the new Ghost-powered D.H. Venom offers higher speed and yet greater fighting effectiveness at altitude. Further proof of the innate potentialities of the tried Vampire design came with the appearance of the first British jet night fighter, a D.H. private-venture. The Meteor, also, was shown capable of further development; remaining the world's faster-climbing standard intercepter, it now presents, in Mk 8 form, better level performance and a number of other improvements.

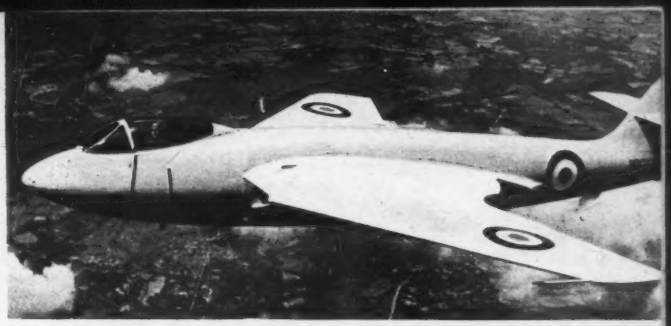
Now styled Sea Hawk, the Hawker intercepter is finally in production for Naval Aviation, while its raked-wing development, the P. 1052, has shown a marked jump in speed without loss of control qualities. A more ambitious future than the originally conceived research programme has been suggested for this graceful prototype. Parallel progress has been achieved by the Supermarine concern: production models of the Naval Attacker have appeared, and the arrow-like Type 510 experimental aircraft has explored the higher Mach regions. At Farnborough the 510 impressed with superb power-assisted manœuvrability as well as fast low-level runs which approached 670 m.p.h.

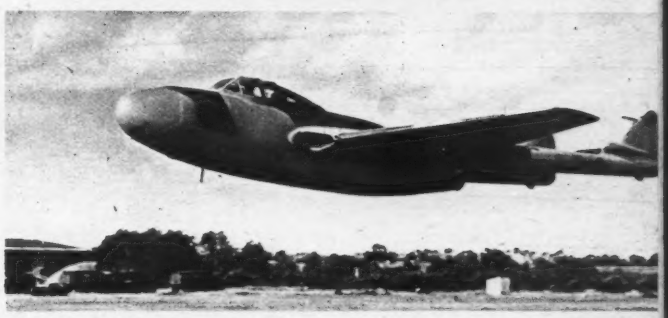
From the Avro stable came these contrasts : the sturdy Shackleton for maritime reconnaissance (upper view) and the Avro 707 delta-wing research aircraft, powered by a single Derwent.



The Varsity, designed to meet R.A.F. crew-training requirements, was a development of earlier successful Vickers aircraft. Shown beneath, in Python-powered form, is the Wyvern naval strike fighter.





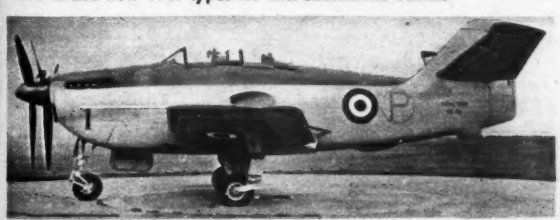


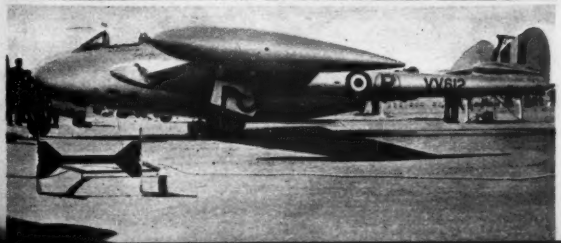
Four of the year's most interesting military types : the combined speed and grace of the Canberra jet bomber (top left) are rivalled by the Hawker P.1052 opposite ; the Supermarine 510 (lower left) and the D.H.113 are neat developments of earlier types. The 510 is for high-speed research, while the 113 is a two-seat, nocturnal version of the Vampire day fighter.

Among bombers, the English Electric Canberra captured immediate attention. In a few months this first British jet bomber showed the hallmarks of a winning design, its high all-round performance and fighter-like agility being accompanied by the possibilities of great versatility. Work proceeded on other, heavier jet-bomber designs, but of these nothing may be said. Pending Service usage of the new-era bombers, Lincolns and Lancasters faithfully remain in interim employment. The replacement of Beaufighters by Brigand light bombers was a welcome, if tardy, step. A complete newcomer in the rarer, piston-engined category was the formidable Avro Shackleton, seen to possess, among other notable features, a massive bomb-bay, four Griffons driving contraprops, extensive radar and particularly heavy armament, although the rear turret will not be retained in service. The Shackleton should provide "Coastal" with a roomy and enduring patrol bomber.

The R.A.F., apparently, is not prepared to undertake extensive turboprop development and (according to the results of current trials) the Athena or Balliol advanced trainer will go into service in Merlin-powered guise. Although the decision to use the earlier power unit was doubtless dictated by sheer economic necessity, the Mamba and Dart turboprops installed in the Mk I version of each of these attractive trainers would eventually have offered many operational advantages. Limited development of the Athena I and Balliol I continued. Experience gained in large-scale operation of the Prentice basic trainer was embodied in the specification for a Prentice replacement, to which Handley Page (Reading), Ltd., and Percival Aircraft are building prototypes. Both aircraft will be Cheetah-powered. Another trainer in the news was the handy D.H. Chipmunk, now in full production for the R.A.F.V.R. Operational and advanced training underwent changes in equipment, a fact borne out by the successful introduction of two-seat Meteor 7s for instrument flying practice with fighter squadrons, and jet conversion at advanced flying schools. Well equipped for the new role of crew-training, the Vickers Varsity was further evidence of the trend. R.A.F. communications work was taken over by the Devon, trim Service version of the renowned Dove, while Naval Aviation adopted the Prince feederliner for this task. Naval Princes are also to be used as crew-trainers.

Another Vampire development is the Ghost-powered Venom, shown at the foot of the page. The Fairey 17 and the Blackburn Y.A.5 (top) were brand-new 1949 types for anti-submarine duties.





Specialized Naval types in production included the Sea Fury T. 20 high-speed trainer, and the Short Sturgeon 2 target-tower. The versatile Supermarine Seagull amphibian, to which a third fin has been added, was demonstrated as a useful Sea Otter replacement, although orders have not yet been announced. The Eagle-engined Westland Wyvern, in company with the Sea Hawk, successfully completed deck-landing trials during the year, and the Farnborough performance of the production-type Wyvern, powered by a Python turboprop, left no doubt that this speedy, powerful strike fighter would be a great asset to Naval strike squadrons. Another turboprop, the promising Double Mamba, is installed in the new Fairey 17 anti-submarine aircraft. Likewise, a 1949 newcomer, the Blackburn YA5, is designed for similar duties and will eventually take a turboprop, although it temporarily has a Griffon.

Investigation of new aerodynamic forms and power-units continued steadily throughout the year. Designed solely for exploration of delta-wing characteristics, the Avro 707 was the most interesting of new research aircraft. The unfortunate crash of the first example has, however, by no means caused cessation of the delta-wing research programme. Less in the limelight, machines such as the DH. 108 and the numerous "test beds" nevertheless continued to sow the seeds of even greater achievements.

(*Continued on page 828*)

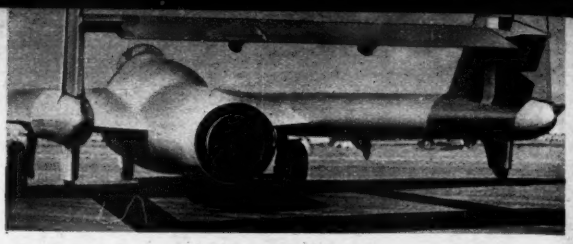
POWER UNITS

FOR the engine manufacturers 1949 has been largely a year of consolidation, as evinced by numerous type tests (many at full design ratings) and extensions of overhaul periods for both piston engines and turbines. The major effects of these two important processes are, respectively, of proving, and increasing confidence in, the newer units, and of reducing the operating costs of civil aircraft.

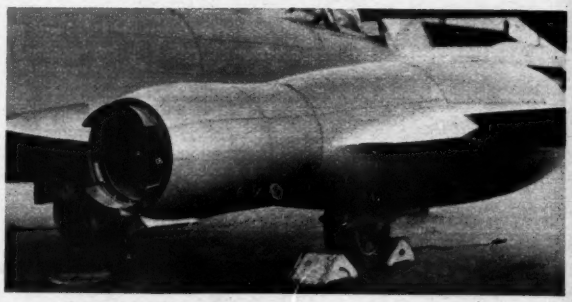
Not until the end of the year was one of the most outstanding power units—the axial-flow Rolls-Royce Avon—revealed (photographs appear on this page and elsewhere in this issue). In addition to the performance of the Canberra, which needs no qualifying adjective, proof of the Avon's potentialities was supplied by the experimental Meteor "test-bed": its rate of ascent suggested vertical climb by future Avon-powered fighters. Fully type-tested D.H. Ghost 3s of 5,000 lb thrust were installed in the Comet, and the reliability of this important centrifugal turbojet was further demonstrated in the air. Especially creditable was the achievement of A. V. Roe, Canada, Ltd., in completing—and beginning tests of—the Orenda, an axial unit comparable with the Avon in size and power.

Among turbojets in full service, the reputation for reliability of the D.H. Goblin was further enhanced by a second 500-hour type-test run, and extension of its overhaul period to the record figure of 600 hr. The Derwent, now installed in the successful Jetliner, completed the first endurance test of its type—100 hr at combat rating, and licences were signed late in the year for its manufacture in Belgium. Not only Britain, but America and France also, continued production of the Nene. Overseas examples of successful Nene application were found in abundance at the Paris Salon, and the U.S.N. uses Turbowasp (Nene) powered Panthers. Guarded announcements were made concerning the Tay, a more powerful—although similarly sized—version of the Nene, which takes advantage of metallurgical developments. Pratt and Whitney will produce Tays also for the U.S. Navy. Last year's progress with development of the Metrovick Beryl was followed by the revelation of a succeeding turbojet, the Sapphire. Work on this unit has been taken over by Armstrong Siddeley.

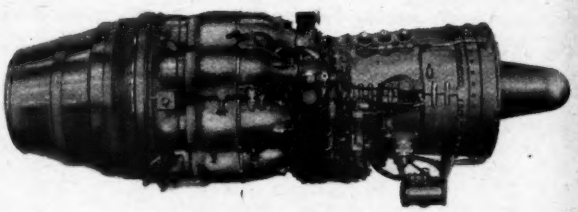
Steady overall advances were made with turboprops. Armstrong Siddeley's 4,000 h.p. Python completed a 150-hr civil and military type-test, becoming the world's largest single aircraft engine to do so. Python flight-development began in the Wyvern strike-fighter and a Lancaster test-bed with two turboprops outboard. Rolls-Royce will increase turboprop experience with the Clyde, but production will not take place, due to more urgent military commitments. Full details were issued of the Bristol Proteus turboprop, which, in paired form, will power the production Brabazons and Saunders-Roe Princesses. Minor Proteus teething-troubles, however, are likely to delay the giant aircraft by a few months. The Rolls-Royce Dart, four of which will each deliver 1,400 h.p. to production Viscount 700s, became the first unit in its class to be accepted for airline passenger service, and successfully passed its type-



Goblin reheat installation on the Vampire.



The reheat Meteor's Derwent 5s have variable area jet-nozzles.

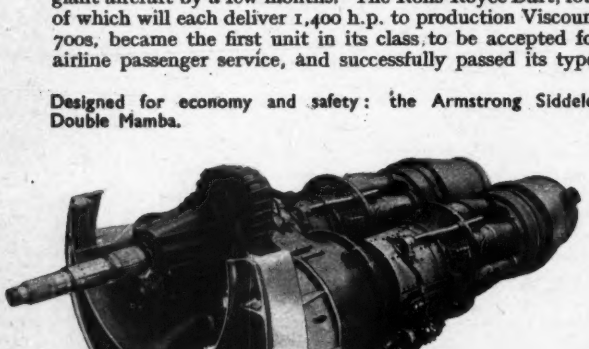


Newly released—the Rolls-Royce Avon.

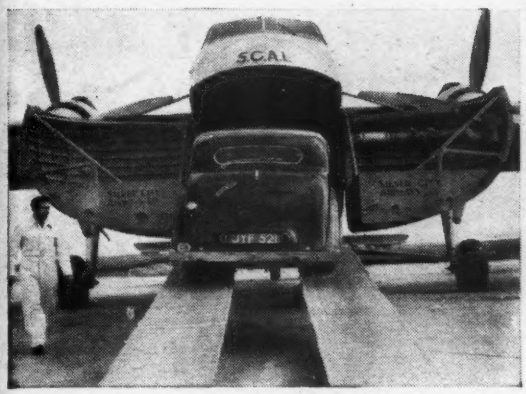
Britain's first rocket unit, the de Havilland Sprite.

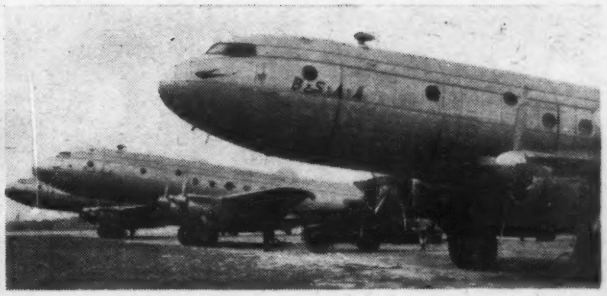
De Havilland Ghost turbojet.

Designed for economy and safety: the Armstrong Siddeley Double Mamba.



Rolls-Royce Dart turboprop.





An instance of the enterprising 1949 work of the charter companies was the Lympne-le Touquet car ferry (left) flown by Silver City Airways. Tudor tankers of B.S.A.A. (above) exemplify the Civil Lift, by both State and charter aircraft.

THE YEAR PAST . . .

test at a rating of 1,250 h.p.

Notable Armstrong Siddeley Mamba developments included installations for the Apollo and an experimental Dakota, and the employment of a Double Mamba in the Fairey 17. A similar combination of independent units driving co-axial airscrews, the Napier Double Naiad, was also announced. Important forms of power previously neglected were rocket motors and afterburning—now exemplified by the D.H. Sprite cold liquid-fuel unit for take-off assistance, and the reheat Derwent and Goblin. Further developments in this sphere including liquid injection may be expected.

So far as piston engines are concerned, transport power units, including the Leonides, Hercules, Centaurus, Gipsy Queen and Merlin, together with lighter D.H. and Cirrus engines have all given increasingly good service. Towards units for ultra-light aircraft, however, progress has been very slow, and there is at present a definite gap within this category.

CIVIL AVIATION

IN similar reviews in past years this particular section has more than once begun with a note of apology for the fact that there was little to record other than more or less routine happenings. The year just ending calls for no such expression; it can be said to have heralded the advent of the jet-powered airliner, and the revelations of Farnborough will long be remembered for the widespread international interest which was manifest in the spectacular displays of the latest civil air transports.

Although occurring late in the year, the reaction which was caused throughout the world justifies mention of Farnborough at the beginning of this section. Subsequent revelations of the performance of British turbine transports augur well for their early introduction into existing airline services.

In the international field, the negotiations for bilateral and multilateral agreements on various aspects of civil aircraft operation continued under the leadership of the I.C.A.O. and I.A.T.A. organizations. I.A.T.A. in particular should be mentioned for the speed and precision with which it dealt with the complex international airline problems caused by devaluation of the pound sterling. I.C.A.O. to date has 55 member-nations and I.A.T.A. a membership of some 68 major airline representatives.

Foreign airlines have, for the most part, started ascending into the profit-making spheres of operation, and throughout the world their work has been characterized by increased frequencies, inauguration of new routes and better operating economics.

As for events rather than tendencies, it will be fitting to give a brief chronological diary, with emphasis placed largely on the aspects which most closely affected this country.

Arrangements for permitting charter companies to operate scheduled services as associates of British Airways Corporations were announced in January. New licensing regulations were made public in March. That month was notable also for two important announcements affecting the future of the Corporations: Lord Douglas of Kirtleside was appointed chairman of B.E.A., and the process of merging B.O.A.C. and B.S.A.A. was begun. Excellent progress with B.E.A. helicopter night-mail operations was made, and definite advances in helicopter instrument flying became apparent.

M.C.A. announced in April the decision to instal the radio-range system of navigation in Britain; it will cover all the major air-lanes and Service as well as civil air traffic.

July brought the end of the Civil Air Lift, an outstanding combined effort by 16 companies responsible for carrying 132,000 tons of supplies into Berlin. The decision, welcome as was its broader aspect, brought acute problems to many of the operators. In the same month, the welcome announcement was made that Tudors Mk. II and V, which achieved a distinguished record on the Lift, were again permitted to carry passengers. New M.C.A. traffic plans for the United Kingdom, to come into full effect in 1951-52, were announced in August. British Airways' statistics for the year ending March, 1949, were made public, and gave a picture of steady overall expansion of the major service. B.E.A. celebrated the 30th anniversary of regular London-Paris services by two pleasing announcements—that the Viscount 700 had been ordered and that B.E.A.'s first profit had been made the previous month.

The three corporations announced reduced losses for the previous year, and redoubled their efforts to ensure completely "streamlined" internal organization, as witnessed by the B.E.A. recovery plan and revised B.O.A.C. organization, both revealed in November.

Among notable Corporation appointments were those of Sir Miles Thomas as chairman of B.O.A.C., in June, and Mr. Peter Masefield as chief executive, B.E.A., in October. Devaluation of the pound, in that month, caused an increase in the British Airways' sterling fares, and other economic disruptions.

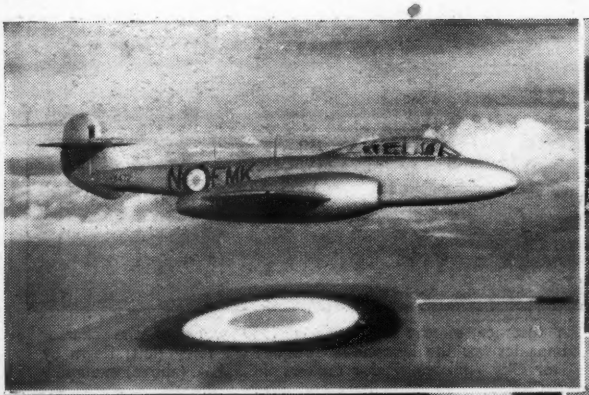
In the main, events towards the end of the year tended to confirm the overall impression that a solid foundation has been laid for future prosperity, although actual operating results to date have not been spectacular. Pending the use of new British airliners under development, good use is being made of present equipment. Canadair Fours have been successfully introduced and B.O.A.C.'s Stratocruiser service began this month, five of the fleet of ten having been delivered to date. Good utilization of the now-veteran B.E.A. Vikings has characterized the continental services, due in part to progressive increases in the overhaul periods of their Hercules power-plants. Confidence has been expressed in the profit-making potentialities of future types—the Viscount and Ambassador—while the Rapide replacement specification has attracted serious tenders from nine manufacturers. Notwithstanding criticism, B.O.A.C. has shown independence by deciding to give every opportunity to the mighty S.R.45 Princess flying boats to prove their worth.

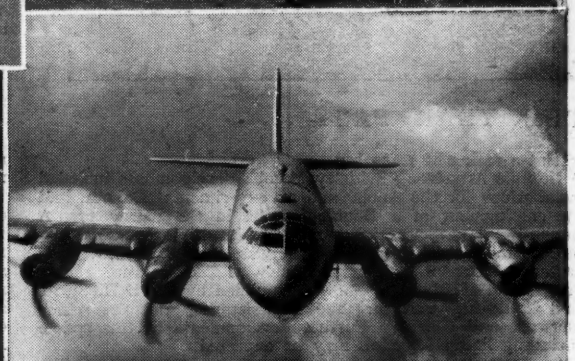
SERVICE AVIATION

FOR the air forces of this country, other Western Union nations and the United States, 1949 proved to be the most progressive year since 1945, when the end of the war inevitably caused considerable disruption. It is true, nevertheless, that traces of that unsettlement were still evident at the beginning of 1949, when the state of the R.A.F. was the subject of national controversy.

To-day, although no grounds for complacency exist, there are abundant signs of real progress towards the goal of a necessarily small, but compact, mobile and highly efficient system of air defence and attack.

Such progress is apparent from a brief chronological outline of the year. In January came a sign of official recognition





Typifying Service activity in 1949 : new equipment for the R.A.F. included numbers of Meteor 7 trainers (top left) and Hastings transports (lower right) ; the latter began operation on trunk routes to the Far East on conclusion of the Air Lift. Above (right) is a representative scene on September 17th, during Battle of Britain Week, when 82 R.A.F. stations were open to the public. Pictured together at Bomber Command H.Q. during Exercise *Bulldog*, also in September, are the commanders of the major components involved—Air Marshals Sir Aubrey Ellwood (Bomber Command) and Sir Basil Embry (Fighter Command), Gen. Sir G. I. Thomas (A. A. Command) and Gen. L. W. Johnson (3rd Air Division, U.S.A.F.)

THE YEAR PAST . . .

of the paramount importance of the R.A.F. in relation to the nation's defence structure—the appointment of Air Marshal Sir William Elliot, former A.O.C.-in-C., Fighter Command, as Chief Staff Officer to the Ministry of Defence. At home, proof of the humanitarian capabilities of air transport was supplied daily by the Berlin Air Lift's successful winter progress and, overseas, by a smaller counterpart, the relief operation by the R.A.F. in Arabia. Another military occasion with civil associations was the demonstration of various types of air ambulance, including helicopters, by Transport Command at Brize Norton.

The re-formation of No. 43 Squadron at Tangmere, in February, and the Bomber Command Reunion the following month were different expressions of the same regard for R.A.F. achievements which have already become tradition. Notable Naval Aviation developments announced in February were the use of flexible flight-decks for aircraft carriers, and the inclusion of a light fleet carrier in a Naval force destined for a period of experimental operation in Arctic waters. The revival of the Esher Trophy competition for R.Aux.A.F. fighter squadrons, a contract for R.A.F.V.R. Chipmunks to replace Tiger Moths and the formation of the Auxiliary A.O.P. Force were three events—all in March—which focused interest on the increasing importance of the air reserve forces. Also in this month came the first of the year's major manœuvres—an air defence exercise in Scotland. The graduation of the first complete post-war course from the R.A.F. College, Cranwell, took place in April—a welcome renewal of the system which has produced many prominent high-ranking officers of the R.A.F. to-day. An outstanding event in May was the Chief of the Air Staff's Conference *Ariel*, in which problems affecting every aspect of the R.A.F. were discussed between members of civil professions as well as high-ranking Service authorities.

The end of June saw the opening of two full-scale air exercises. The first, code-named *Foil*, was primarily a test of Britain's air defences, by day and night, and was particularly notable for the smooth co-operation between the British, U.S., Netherlands and other Western Union units involved. Mainly naval, Exercise *Verity* also gave invaluable experience to Western Union air forces and carrier-borne squadrons. In these, as in other 1949 exercises, the keen spirit of the forces engaged was a reward additional to the operational lessons learned. Service activity was also marked during August: Meteors made a successful good will tour of Scandinavia (Vampires made similar visits to Turkey and Italy later in the year), and the British Air Forces of Occupation staged an impressive show of tactical air power at Gutersloh in the British Zone of Germany. It was announced during the same month that Marshal of the R.A.F. Lord Tedder was to be succeeded as C.A.S., in the New Year, by Air Chief Marshal Sir John Slessor. In August, also, were announced the formation of the Fighter Control Branch and the amalgamation of the R.A.F. Empire Schools.

Bomber Command, supported by B-50s and B-29s of the U.S.A.F., was out in full strength during Exercise *Bulldog*, in September. The exercise proved the ability and high morale of the crews, and also endorsed the urgent need for more advanced bombers and night fighters. Following the termination of the Air Lift early in October, Transport Command (strengthened by the acquisition of Hastings and Valettas) returned to routine work on the trunk routes to overseas commands. More recently there have been reports that the need for national economy may necessitate a reduction in the size of Transport Command.

Throughout the year came recurring announcements of overseas sales, or licences for overseas production, of British military aircraft, particularly fighters. Such agreements not only increased our own export drive and the air power of allied or friendly nations, but also testified to the high standards of equipment used by the Services.

DESIGN of TURBOPROP TRANSPORTS

Mr. A. E. Russell's Lecture to the I.Ae.S. in Washington

PART 1: Design-essentials Imposed by the Turboprop

THE 13th Wright Brothers Lecture was this year given before the Institute of Aeronautical Sciences in Washington on December 17th. Under the title "Some Factors Affecting Large Transport Aeroplanes with Turboprop Engines," it was presented by Mr. A. E. Russell, B.Sc., A.F.R.Ae.S., chief designer (Aircraft Division), Bristol Aeroplane Co., Ltd.

Mr. Russell opened his address by stating that, during the last few years, the Bristol Company had devoted a considerable proportion of its effort towards the design and development of large transport landplanes with turboprop power units. With the adoption of this engine and the consequent rise in cruising speed and operating altitude, together with the increasing size of aircraft, new technical problems had been introduced and old ones had been amplified.

FOR the past thirteen years, on December 17th, the anniversary of the first successful controlled flight of a heavier-than-air machine, the American Institute of the Aeronautical Sciences has held the Wright Brothers Lecture. It is the complement to the Wilbur Wright Memorial Lecture given each year in England before the Royal Aeronautical Society.

Mr. Russell, who presented the Washington lecture this year, is assured of aeronautical fame as the man chiefly responsible for the Brabazon I design. In the first part of his paper, summarized here, he dealt with the essentials of aircraft design attendant upon the use of turboprops, and in the second part (a digest of which will be included in a subsequent issue) he gave an analysis of structural considerations arising chiefly from accommodating the effects of gusts.

An important condition in the effective use of turboprops was that their operating characteristics were intimately linked with the performance characteristics of the aircraft in which they were installed, for the following reasons: (i) the compression ratio of the gas turbine was not constant, but increased with reduced temperature; this led to an improvement in efficiency with increase in altitude. (ii) The compression ratio and peak temperature were functions of r.p.m., which resulted in deterioration in efficiency at part load. (iii) The ram compression-ratio, besides increasing the air mass flow, enabled the working fluid to expand over a higher ratio with consequent increase of power and improved economy.

As was usual in power-plant design, once the fundamental principle had been established, improved economy and performance could be bought only at the expense of increased complexity and weight. Thus, a balance between plant weight and specific fuel-consumption had to be arranged with due consideration of other factors which might affect the overall aircraft performance. A fundamental requirement for high efficiency was to reduce the rate of energy rejection in the exhaust.

It would seem that the immediate programme of development for turboprops should concentrate on improvement of component efficiencies in order fully to exploit the potentialities of the simple cycle when optimum values were prescribed for the main parameters. This approach would result in a light, simple power unit of low frontal area and attractive fuel economy. To explore the scope in this direction, it was convenient to separate the thermal cycle from the means of propulsion and consider the compressor/turbine combination as a gas generator producing "gas horsepower."

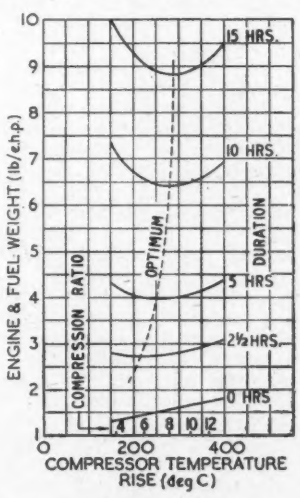


Fig. 1. Curves of turboprop performance at a cruising speed of 350 m.p.h. at 30,000ft I.C.A.N. conditions.

This procedure was satisfactory for turboprops, as the propulsive efficiency was very nearly independent of the thermal efficiency; but it was not so for turbojet types, and might lead to erroneous conclusions. In Fig. 1 was shown a plot of engine - plus - fuel weight against compression ratio for a range of durations, and it could be seen that, for durations above ten hours, the minimum engine-plus - fuel weight was achieved at a compression ratio of about 8:1. For durations up to five hours, the importance of engine weight predominated and compression ratio was not critical; low-compression engines were then best from the points of view of simplicity and initial cost.

On the subject of aircraft performance, Mr. Russell stated that, when reciprocating engines were employed, maximum continuous power available at low altitude was severely limited, as was also the take-off power. These conditions would often result in take - off requirements and airworthiness performance standards having an influence on the choice of wing loading and power loading; this necessary compromise might, in turn, have an adverse effect on the payload/range performance.

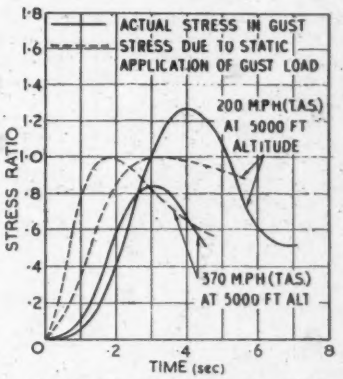


Fig. 2. Curves showing the effect of flexibility on wing-root bending stress owing to passage through a gust.

A different situation obtained when turboprops were employed. This arose from the fact that the power output increased continuously as the altitude was reduced from the cruising altitude to sea-level, and it was unlikely that aircraft performance at the lower levels would be important to the extent of determining gross weight or wing design. For turboprop-engined aircraft, therefore, attention would be directed toward attaining the best possible efficiency under cruising conditions.

When turboprops were used, it was essential to operate the engines at the maximum permitted continuous r.p.m. and power in order to achieve the minimum specific consumption. The only way to reduce the power available so that an economic condition was obtained was to operate at the highest altitude consistent with the maintenance of sufficient reserve climb-performance. This altitude increased as weight was reduced by the consumption of fuel and was rather nearer to the ceiling than to the altitude for maximum speed.

The lecturer considered the effects of some representative

DESIGN OF TURBOPROP TRANSPORTS . . .

alternative flight plans of the type devised by B.O.A.C. These flight plans were respectively (i) maximum cruising speed throughout, (ii) speed for maximum range throughout (nearly zero potential rate of climb), (iii) altitude such that the potential rate of climb was 200ft/min, and (iv) as (iii) except that the maximum altitude was limited to 30,000ft.

TABLE I

Flight Plan	Mean Cruising Speed (m.p.h.)	Still-air range (miles)	Fuel for 5,000 ml.	Difference from Plan 3	Maximum altitude (ft.)
1.	358	4,900	0.386W	+0.048W	33,000
2.	319	5,900	0.328W	−0.010W	39,000
3.	342	5,700	0.338W	—	39,000
4.	348	5,100	0.372W	+0.034W	30,000

In Table I was compared the results of following the various flight plans as the weight of the aircraft fell due to the consumption of fuel. The precise initial weight was not important in this comparison and had been taken as 300,000 lb. Still-air range (col. 3) assumed that the fuel available amounted to 37.5 per cent of the initial weight. It could be seen that, with one exception, differences between the mean speeds were relatively small, on the other hand, the available range with a given quantity of fuel, or the weight of fuel required to fly a given distance, varied in a most significant way, for if the payload of a fully equipped civil aircraft was taken as 0.10 W for Plan 3, then for Plan 1 it would be only one-half that amount. It could be concluded that the best plan was No. 3 and this would be used for subsequent investigation of the effects of other variables on long-range operations. Incidentally, Plan 3 corresponded almost to constant lift-coefficient.

Having established that turboprop aircraft operate closely to prescribed cruising procedures, Mr. Russell then went on to examine the effect on operating efficiency of varying the wing area and aspect ratio. He demonstrated that a reduction of wing loading raised the cruising altitude and, hence, the economy, but the amount of improvement was comparatively disappointing as the increase in drag had a large detrimental effect. Purely from performance considerations, an increase of aspect ratio could be expected to have a more favourable effect in that a reduction in induced drag led both to higher altitudes and higher cruising speeds.

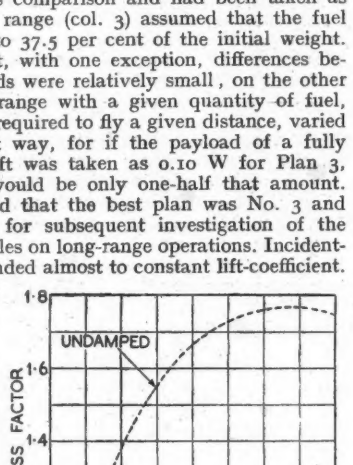


Fig. 3. Plotted variation of overstress factor with speed for a 170ft-span wing and a 100ft gradient distance at sea level.

Turning to considerations of power loading, the lecturer observed that, at a fixed initial weight, the primary effect on range and payload of an increase or decrease in engine power was, perhaps surprisingly, nil. Where long range was of paramount interest, a moderate reduction in the specific consumption was of more value than a large increase in power. It was clear that the circumstances were quite different from those obtaining with piston engines. Additional power to permit an increase of gross weight by overcoming some critical low-altitude operating conditions, and thereafter throttling back to a more favourable power for fuel consumption in cruising flight, was no longer possible.

Mr. Russell referred to the analysis of structural characteristics, and stated that, with greater size, greater masses and greater structural deflections, it was apparent that the dynamic response under the action of rapidly applied external forces could produce different values from those estimated by static analysis. For this investigation, a knowledge of the behaviour of structure in vibration was required. After touching briefly on the normal modes of vibration, and their calculations, he went on to state that the introduction of shear deflection and shear lag, together with a greater number of degrees of freedom—including, perhaps, engine nacelle and tailplane flexibilities—made the calculation of the higher modes of vibration a lengthy process. The sixth mode was probably the upper limit to which calculation could normally be applied, and for the higher modes there was a distinct advantage in the use of a vibration model.

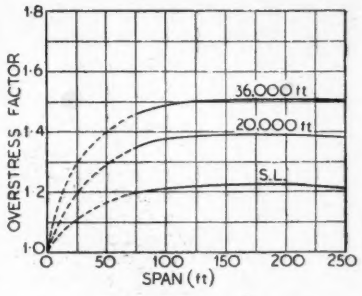


Fig. 4. Curves of overstress factor plotted against span for a 100ft gradient distance at varying altitudes.

By building a model which reproduced the elastic and inertia properties of the aircraft to some suitable scale, and by applying an exciting-force to the model, it was possible to measure the frequencies and the shapes of the normal modes in much the same way as the modes were derived from resonance tests on complete aircraft. It had been the practice for some time to carry out ground resonance tests on prototype aircraft prior to their first flight, and this served as an experimental check on their flutter and vibration characteristics. Mr. Russell suggested, however, that this was a very late stage to discover, for the first time, that some intrusive mode asserted itself in embarrassing company.

Applied unsteady forces to an aircraft in flight might arise from either an intentional change in the flight path, or from atmospheric disturbances. Taking the case of an aircraft flying into an uprising current of air, the build-up of aerodynamic loads was complex. During the time the aircraft was accelerating vertically, the vertical velocity thus acquired reduced the effective gust velocity. A certain amount of pitching might also occur, depending upon the stability characteristics of the aircraft. The Wagner effect, too, was important. A sudden change of incidence did not immediately produce the lift appropriate to steady flow conditions; there was a time lag during which the system of vortices was built up. By slowing down the application of the gust load, this lag acted as an increase of gust gradient distance by allowing more time for vertical velocity to accrue.

In a gust, the three main factors, viz., dynamic response, vertical motion and Wagner effect, while complicating the problem on their own, also suffered from considerable coupling, for example, (a) the change of incidence due to vertical motion of the aircraft did not produce an alleviating air load immediately; (b) the flexural response of the wing was aerodynamically damped and this was subject to lag; (c) dynamic responses in the torsional modes caused wing twist which modified the lift, and (d) the free vortex sheets associated with the transient changes in lift modified the lift on the tailplane.

In view of the complicated nature of the aircraft response, it was not surprising that reliable evidence on gust shapes and velocities had been lacking. In British design practice, a range of gradient distances was considered and the maximum velocity was sustained. The procedure was to treat the problem as if it were static and then add the difference between the dynamic and static responses of the lower modes of vibration of the aircraft. At any given

DESIGN OF TURBOPROP TRANSPORTS . . .

altitude, higher cruising speeds would increase the severity of the aerodynamic loads due to the gust. There was, however, an important alleviating effect arising from aerodynamic damping. It could be found that damping would decrease in importance with increasing altitude, and increase rapidly with increasing speed.

These points were illustrated in Fig. 2, which showed the results of calculations carried out on an aircraft of 230ft span and 300,000 lb gross weight. The conditions were for a gust of 50ft/sec E.A.S. vertical velocity and a gradient distance of 100ft. The points of interest were: (i) at 200 m.p.h. the stress ratio due to overswing was about 1.25, and (ii) at 370 m.p.h. the flexible aircraft apparently experienced less stress in the gust than would be calculated if the gust had been treated as a static problem.

Hence the highest speed associated with a given gust intensity would not necessarily give the worst design conditions, and it appeared that, as cruising speeds for large aircraft rose, the importance of the "gust at cruising speed" diminished.

Overstress Factors

Mr. Russell presented a typical plot of overstress factor against speed at sea level (Fig. 3), the dotted curve showing the value of the factor if zero damping was assumed. This curve showed clearly the importance of damping at all operating speeds, and particularly at the higher speeds. It could also be seen that the maximum overstress factors occurred at about the present-day values of cruising speed. Similar plots for a variety of aircraft (representative of current practice and with spans of from 70ft to 230ft) at various altitudes had been made, and had been used to construct Fig. 4, which showed the maximum overstress factors as a function of span, with altitude as a parameter. The most striking thing about these curves, observed Mr. Russell, was the rapid curving-over at small values of the span, followed by a roughly constant factor for all values of the span from 100ft to 250ft. There was, of course, a simple physical explanation as to why, contrary to earlier expectation, the very-large-span aircraft did not, in fact, experience much greater overstress than the (comparatively) smaller machines. At a given altitude and forward speed, the aerodynamic damping forces were proportional to the vertical velocity of deformation of the wing. In flying through the same gust, the large machine would experience deflections greater than the smaller one, roughly in proportion to span, i.e., a 250ft-span machine would experience 2½ times the deflection of the 100ft-span type. The time in which this deflection took place, however, was clearly not much greater than for the smaller span, so that the *rate* of deflection and, consequently, the damping force also, was about twice that of the smaller aircraft. Thus it came about that what the large machine lost owing to its slow frequency of oscillation, it gained on the grounds of superior damping in flexure.

The effect of altitude was also indicated in Fig. 4. The maximum overstress factor, about 22½ per cent at sea-level, had become no less than 50 per cent at an altitude of 36,000ft. An increase of the gradient distance to 200ft in place of 100ft would reduce this figure approximately to 30 per cent.

The general conclusions that could be drawn from this study of dynamic response to a gust constant in shape and velocity were as follows: (i) at any given altitude, the overswing factor increased with increase of speed, until aerodynamic damping over-rode the gust effect. With further increase of speed, the overswing factor became smaller until the wings became dead-beat or better. (ii) The maximum value of overswing factor was apparently independent of aircraft size. (iii) The speed at which the overswing factor reached its maximum value decreased with increase of aircraft size. (iv) The overswing factors increased with increase of altitude owing to decreased damping.

It appeared that, at high cruising speeds, the gust cases were actually less severe on large aircraft than on smaller ones and, therefore, on this count, there was no limit to size.

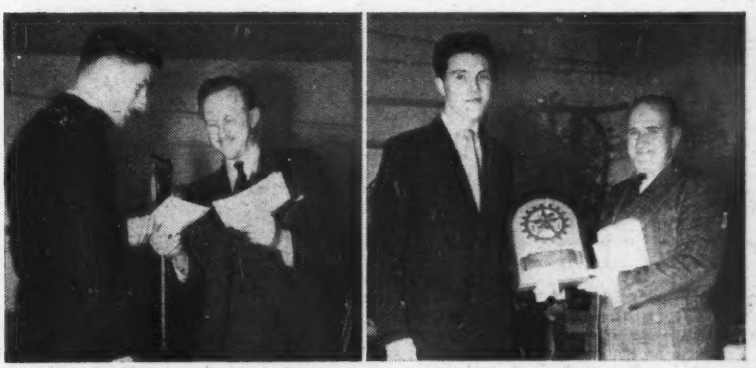
(To be concluded)

ENCOURAGEMENT for APPRENTICES

PRACTICAL encouragement for the enthusiasm of its trade, student and graduate apprentices has long been the policy of D. Napier and Son, Ltd., and on December 14th, at the Acton works, a most impressive list of prizes, certificates and indentures was formally awarded to over 100 young men. This, the fifth annual presentation, was made the occasion of a social evening, and the guests afterwards visited the works and saw an exhibition of apprentices' work in the main fitting shop.

After the reading of the apprentice supervisor's report and an address by Mr. J. T. Moore, B.Sc., M.I.E.E., A.M.I.Mech.E. (chief engineer, English Electric Co., Ltd.), indentures and merit awards were distributed by Mr. J. S. Paget, B.A., A.M.I.Mech.E., M.I.P.E. (manager, Napiers); Mr. H. Sammons, M.I.Mech.E., F.R.Ae.S. (the managing director), presented merit certificates; Mr. P. Brennan (chairman, foremen's association) gave away the Foremen's Trophy and prizes; and Mr. H. G. Nelson, M.A., A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E. (deputy managing director of English Electric and a director of Napiers), presented the Company's Trophy (for the best student apprentice) and other prizes.

The last-named award went to D. G. J. Caddy (design draughtsman, Luton works), while D. N. Pink (precision machinist, experimental machine shop) took the Foremen's Trophy. Nine certificates of merit were awarded, and there were no fewer than 104 merit awards, ranging in value from £16 for the best fifth-year apprentice to £6 10s for the best first-year man. In all, the value of awards presented totalled £653.



Presentations: Left, Mr. J. S. Paget, manager, gave indentures and merit awards to successful apprentices. Right, D. N. Pink receives the Foremen's Trophy (for the best trade apprentice) from Mr. P. Brennan.

MR. JAMES GRAHAM

IT is with regret that *Flight* has to record that on December 16th Mr. James Graham, since 1934 chief inspector of the Heston Aircraft Co., Ltd., died suddenly in his office.

Mr. Graham began his work in aviation at Farnborough in 1915, was later with British Nieuport, and then for ten years was works manager to Major J. C. Savage of sky-writing fame. After a period as works manager of Comper Aircraft he joined the Heston Aircraft Co.

"Mac will be sadly missed by all his friends in the industry," writes a colleague. "He was a typical Scottish engineer of the best type."

CORRESPONDENCE

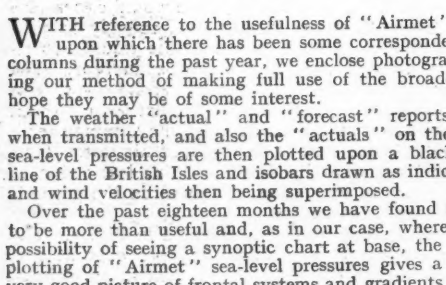
The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

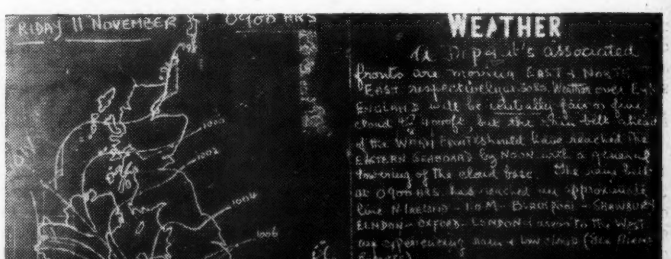
WITH reference to the usefulness of "Airmet" as an aid, upon which there has been some correspondence in your columns during the past year, we enclose photographs indicating our method of making full use of the broadcast, in the hope they may be of some interest.

The weather "actual" and "forecast" reports are copied when transmitted, and also the "actuals" on the half-hour: sea-level pressures are then plotted upon a blackboard outline of the British Isles and isobars drawn as indicated, fronts and wind velocities then being superimposed.

Over the past eighteen months we have found this method to be more than useful and, as in our case, where there is no possibility of seeing a synoptic chart at base, the plotting of "Airmet" sea-level pressures gives a very good picture of frontal systems and gradients over the British Isles.

Brough, E. Yorks. W. G. CROOKS,
Senior Navigator,
North Sea Air Transport, Ltd.





(Right) How North Sea Air Transport—see first letter—plot Airmet broadcasts. Above is a section of one of their airfield-weather reports prepared from the same source.

THE MUSEUM PROJECT

IN view of the fact that yourself and also many of your readers have shown interest in my scheme for a museum of early mechanical transport to be opened in a semi- or non-built-up area, I thought it might possibly prove of interest to give you some details on how this scheme has progressed in the meantime.

Since the war I have made eleven unsuccessful attempts to get the scheme passed on various sites in Surrey, Sussex and Kent. The latest attempt, the eleventh, concerned a site on a main road in Surrey a little more than 20 miles from London and with good transport facilities in an area zoned for this type of building, but with definite country outlook. The scheme included the building for the museum; and car and cycle parks suitably shielded from the road and with lawns, flower beds and seats.

The scheme was turned down by the planning committee, the chairman remarking that the site was unsuitable for such a dull subject. One member of the committee asked: "Why not let the scheme go ahead?", but all the others followed the chairman's lead. Incidentally, I noted the results of their deliberations in one of the county papers, on the main news page, and the Editor kindly printed a letter from me in a subsequent issue in which I stated that we had 46,000 visitors to a small exhibition arranged in 1939 for five weeks only and which only included four aircraft from the collection and, in addition, a number of interesting engines, papers, maps, photographs, etc. I felt that this was an adequate answer to the statement that this was a dull subject.

At the present time I know of three similar projects operating in America with great success, and one has reopened in Italy. These are mainly interested in the automobile, and none includes exhibits that could be shown here—over 70 various bicycles and tricycles dating from 1818 and about ten aircraft covering the 1909-18 period.

Unless some suitable site is forthcoming before long, I will be very reluctantly forced carefully to store some of the proposed exhibits and make arrangements for others to be shown in those countries where individual enterprise is not frowned upon. R. G. J. NASH.

Weybridge, Surrey.

[It would be most regrettable if our correspondent's efforts were eventually nullified by opposition of the kind he mentions. *Flight* is convinced of the desirability of establishing such a historical collection whilst suitable exhibits are still available and is, indeed, already taking steps to co-ordinate the suggestions of several persons interested in similar projects.—ED.]

In Brief

J. E. D. Harrison, of 166, Portland Crescent, Stanmore, Middlesex, writes that "many young people today are interested in flying but cannot get to know others with the same interest; they cannot afford to join the flying clubs, so other than joining the R.A.F., W.R.A.F., or A.T.C., etc., which are too military for the liking of many, they have to be content with sitting at home and reading aviation journals." He feels that enthusiasts like himself would be very willing to support a correspondence club or discussion group concerned with aviation matters.

FORTHCOMING EVENTS

Jan. 21. Aircraft Recognition Society: Hurricane Trophy Contest.
Jan. 24. R.Ae.S. (Belfast): "Recent Development in Aircraft Production Engineering," by Prof. Connolly, B.E., F.R.Ae.S.
Jan. 28. Helicopter Association: "Pest Control and the Helicopter," by Dr. W. E. Ripper, F.R.E.S.
Jan. 28. Society of Licensed Aircraft Engineers: "Dowty Electro-hydraulic Systems," by Neville J. Horne.
Jan. 31. Society of Instrument Technology: "Continuous Gauging of Thread or Wire," by L. C. Evans, M. Groneck and H. G. Lee.
Feb. 1 Royal United Service Institution: "Aircraft for Army Uses," by Lt.-Gen. R. N. Gale, C.B., D.S.O., O.B.E., M.C.
Feb. 4. British Interplanetary Society: "Effects of Interplanetary Flight" (discussion).
Feb. 8. R.Ae.S. (Weybridge): "Aerodynamic Consequences of Flying High and Fast," by W. G. A. Perring, C.B., F.R.Ae.S., A.M.I.N.A.
Feb. 8. British Interplanetary Society (Manchester): Astronomical Observatory Visit.
Feb. 8. R.Ae.S. (Belfast): "Rocket Propulsion and Interplanetary Flight," by A. V. Cleaver, A.R.Ae.S.
Feb. 9 R.Ae.S.: "Producing a Prototype Aircraft," by C. T. Wilkins, A.F.R.Ae.S.
Feb. 13. Institute of Transport: Brancker Memorial Lecture—A.V.-M. D. C. T. Bennett, C.B., C.B.E., D.S.O.
Feb. 17. Institute of Navigation: "Air Traffic Control," a symposium of papers.

SERVICE AVIATION

Royal Air Force and Naval Aviation News and Announcements

RE-EQUIPPED: Vampires of the Mk. 5 clipped-wing, ground-attack variety have now replaced most of the Mk. 3s formerly employed by Fighter Command Vampire squadrons, and are also in service with several overseas units. Those shown belong to No. 54 Squadron, based at Odiham.

"Flight" photograph.

New Types for R.N.Z.A.F.

FOLLOWING a visit to England, the Chief of the Air Staff, R.N.Z.A.F. (A.V-M. A. de T. Nevill) has recommended that his Government purchase de Havilland Vampires, Handley Page Hastings and Bristol Freighters, for re-equipping the R.N.Z.A.F. The Freighters and the Hastings are also likely to be used for aerial top-dressing work.

Inter-Command Boxing

BOXING before a packed house at Uxbridge, on December 15th, the Maintenance Command boxing team defeated Flying Training Command by seven matches to five to win the 1949-50 R.A.F. Inter-Command Boxing Championship. The points score was 19 for Maintenance Command and 17 for Flying Training Command.

The championship final, held in the station cinema, was boxed before one of the largest gatherings of high-ranking Air Force officers ever to attend a sports event at Uxbridge. It included the A.O.C.-in-C.s of the two Commands, Air Chief Marshal the Hon. Sir Ralph Cochrane (Flying Training) and Air Marshal T. A. Warne-Browne (Maintenance), members of the Air Staff and other Air Officers Commanding-in-Chief.

The contests included one in the welterweight class, between A/C. T. S. "Terry" Ratcliffe, England and Imperial Services representative this year, and A/C. G. R. Nursey, which Ratcliffe won for Maintenance Command on points.

Maintenance Command was ahead by two points when the twelfth contest, a heavyweight match, opened. By winning it, Flying Training Command could have tied the point score at 18-all, and the reserve contest to follow would have decided the championship. Cpl. L. G. Lamacraft, however, clinched the championship for Maintenance Command by outpointing his opponent in the three two-minute rounds.

PEACE-WORK: Untiring effort by German Air Lift workers has been recognized by the presentation of 12 certificates of commendation to workers at various R.A.F. stations throughout the British Zone of Germany. Herr Gabriel, of Berlin, is seen receiving his certificate from Air Marshal T. M. Williams, C.-in-C., B.A.F.O.

Award

IT is announced by the Air Ministry that the King has been graciously pleased to approve the award of the British Empire Medal (Military Division) to A/C.1 S. A. Allen, R.A.F.V.R. The award has been made for gallantry and devotion to duty.

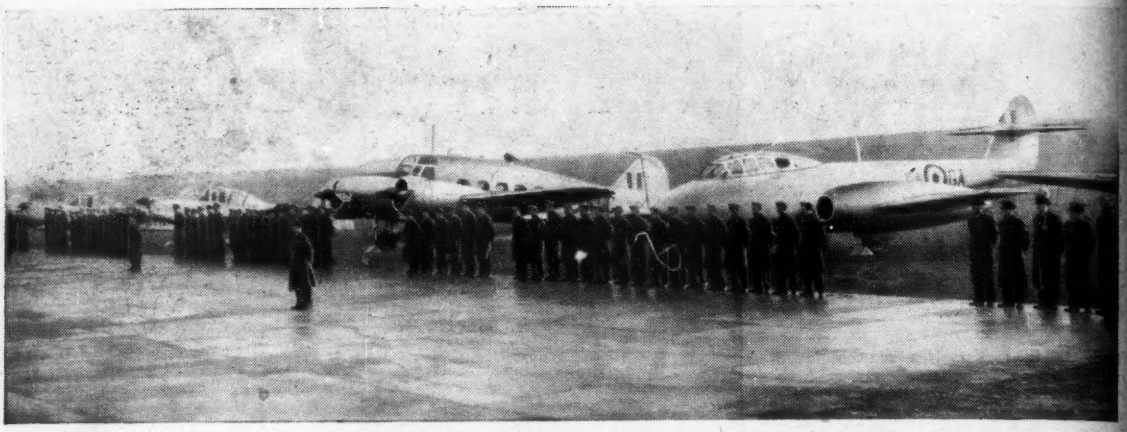
On February 3rd, 1942, A/C. Allen was on board the S.S. *Loch Benas* when the ship was heavily attacked by Japanese aircraft near Singapore. Allen, who was in charge of a machine gun, was severely wounded in the leg, but continued to keep his gun in action and declined medical attention until the attack was over.

To Command R.I.A.F.

HIS Majesty's Government in the United Kingdom have placed at the disposal of the Government of India the services of A.V-M. Ronald Ivelaw-Chapman, C.B., C.B.E., D.F.C., A.F.C., for appointment as Chief of Air Staff and Commander-in-Chief, Royal Indian Air Force. A.V-M. Ivelaw-Chapman will take up this appointment, with the acting rank of Air Marshal, in February, 1950, in succession to Air Marshal Sir Thomas Elmhirst, K.B.E., C.B., A.F.C., who has held the appointment since 1947, and who will be returning to the United Kingdom.

Since September, 1947, A.V-M. Ivelaw-Chapman has been R.A.F. instructor at the Imperial Defence College; he formerly served with the Defence Research Policy Committee for nearly a year. At the outbreak of the recent war he was an air staff officer at H.Q., Bomber Command. In 1940 he was appointed to command the bomber station at Linton-on-Ouse, Yorkshire, and a year later went to the Air Ministry for duty in the Directorate of Plans, becoming Director of Policy in 1943.

In February, 1944, he was given command of a base in Bomber Command and shortly before D-Day took part in an operational flight over France. His aircraft was shot down and he baled out. He escaped into the countryside and was befriended by the Underground movement, but was captured about a month



JET FOR CADETS: Conspicuous among the Prentices, Ansons and Harvards which equip the Flying Wing of the R.A.F. College, Cranwell, is this recently acquired Meteor 7, shown during Field Marshal Sir William Slim's visit to the College (reported in last week's *Flight*). The Meteor is used to give high-speed air experience to cadets undergoing basic and advanced training.

SERVICE AVIATION . . .

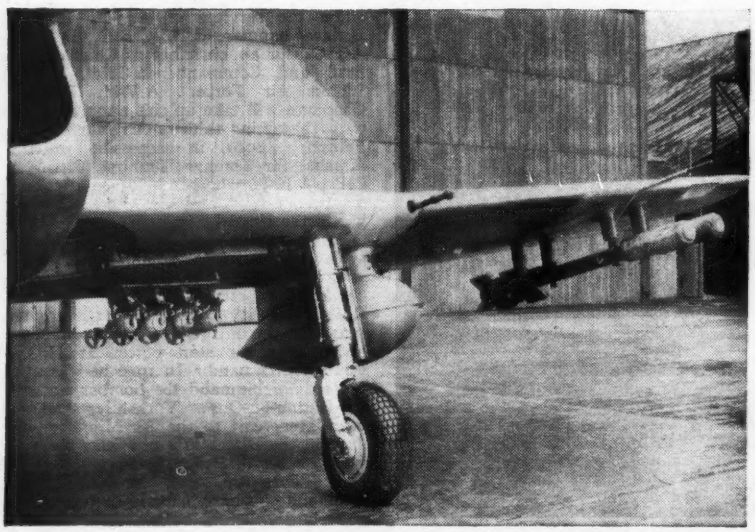
later and sent to a prisoner of war camp, from which he was released by the advancing Allied forces in April, 1945. After his return to the United Kingdom he was appointed Air Officer Commanding, No. 38 Group, Transport Command, with which he remained until his appointment to the Defence Research Committee in December, 1946.

A.V-M. Ivelaw-Chapman, who is 50, was commissioned in the Royal Flying Corps in 1917, transferring to the R.A.F. on its formation in the following year. He was awarded the D.F.C. in 1918 for valuable service in artillery co-operation in France.

Radar Officers Wanted

FORMER R.A.F. and W.A.A.F. officers who were radar supervisors can now apply to return to the Air Force for similar duties in the Fighter Control branch on short-service commissions of five years' active and four years' reserve service. A gratuity is offered at the rate of £100 a year for R.A.F. officers (£65 for W.R.A.F.) for each year of active service. These short-service officers will also have opportunities of permanent commissions according to the normal procedure. The Fighter Control branch, set up last summer, is the medium for alerting and co-ordinating the defences of the country.

This opportunity of returning to the Air Force will be of particular interest to former members of No. 60 Group, which operated many of the R.A.F. radar stations in Britain during the war. Marshal of the R.A.F. Sir Arthur Harris, when A.O.C.-in-C., declared that Bomber Command could not have brought its task to a successful conclusion without 60 Group's work. The Group was also described as "the eyes of Fighter Command" by Air Chief Marshal Sir James Robb, a former A.O.C.-in-C., Fighter Command. Those interested should write to Air Ministry (A.R.7), Bush House (North East), London, W.C.2.



BALLIOL'S BURDEN: The load beneath the wing of this Boulton Paul Balliol T.2 advanced trainer comprises long-range fuel tanks, practice bombs and rocket projectiles. Although such a combination of stores would not normally be carried in flight, the Balliol has in fact flown in this condition, with little effect on its handling qualities.

R.A.F. Chaplaincy Services

THE Rev. C. J. F. Gilmore, who has been Assistant Chaplain-in-Chief at the Air Ministry since 1946, is leaving the Chaplains branch of the R.A.F. at the end of the year, having accepted the wardenship of the College of Aeronautics, Cranfield, where he will begin duty on January 1st. He will be succeeded by the Rev. H. L. O. Rees, at present Staff Chaplain to the Chaplain-in-Chief.

R.O.C. Recruiting

OUT of a total of 369 applications to join the Royal Observer Corps in November, 121 were from women. The applications in each of the five Royal Observer Corps areas were: Southern area, 49 men, 19 women; North-Western area, 43 men, 11 women; Scottish area, 36 men, 9 women. The Air Ministry states that all areas need more volunteers, and offers a reminder that lower age limit for new volunteers is 16, and that the upper age limits are 45 for service at centres, and 55 for service at posts.

Air Ministry Appointment

AIR COMMODORE L. W. CANNON, C.B.E., has been appointed Director of Organization (Establishments) at the Air Ministry. Until recently he was at the R.A.F. Staff College, Andover, as commandant from last January and previously as assistant commandant for a year. Before going to Andover, A. Cdre. Cannon took the 1947 course at the Imperial Defence College and formerly commanded No. 85 Group (afterwards No. 85 Wing), B.A.F.O., Germany, from June, 1946. Previously he was Air Officer in Charge of Administration, No. 2 (Bomber) Group, for two and a half years.

Earlier in the war he served at the Air Ministry, in the Directorate of Operations; at the R.A.F. Staff College as an instructor; at Bomber Command H.Q., on engineering staff duties; and in command of R.A.F. Stations, Watton, Foulsham, Lasham and Dunsfold, in No. 2 Group. A. Cdre. Cannon, who was born in April, 1904, was commissioned from the Royal Air Force College, Cranwell, in 1925.

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